ENGINEERING LIBRARY

The OIL WEEKLY

FOR THE DRILLING, PRODUCING, PIPE LINE INDUSTRY

Thru the Ages with Hughes Rock Bits

Painted for the Hughes Tool Research Division Collection by John Pemberton Cowan

THE CARBONIFEROUS PERIOD: *Pennsylvanian and Mississippian) consisted of a luxuriant growth of plant life which was later compressed into thick coal beds and other hard formations. Pictured above* are animal and plant life of the period, including primitive amphibious reptiles and huge flying insects.*

*Full size color prints of this original painting will be sent upon request.

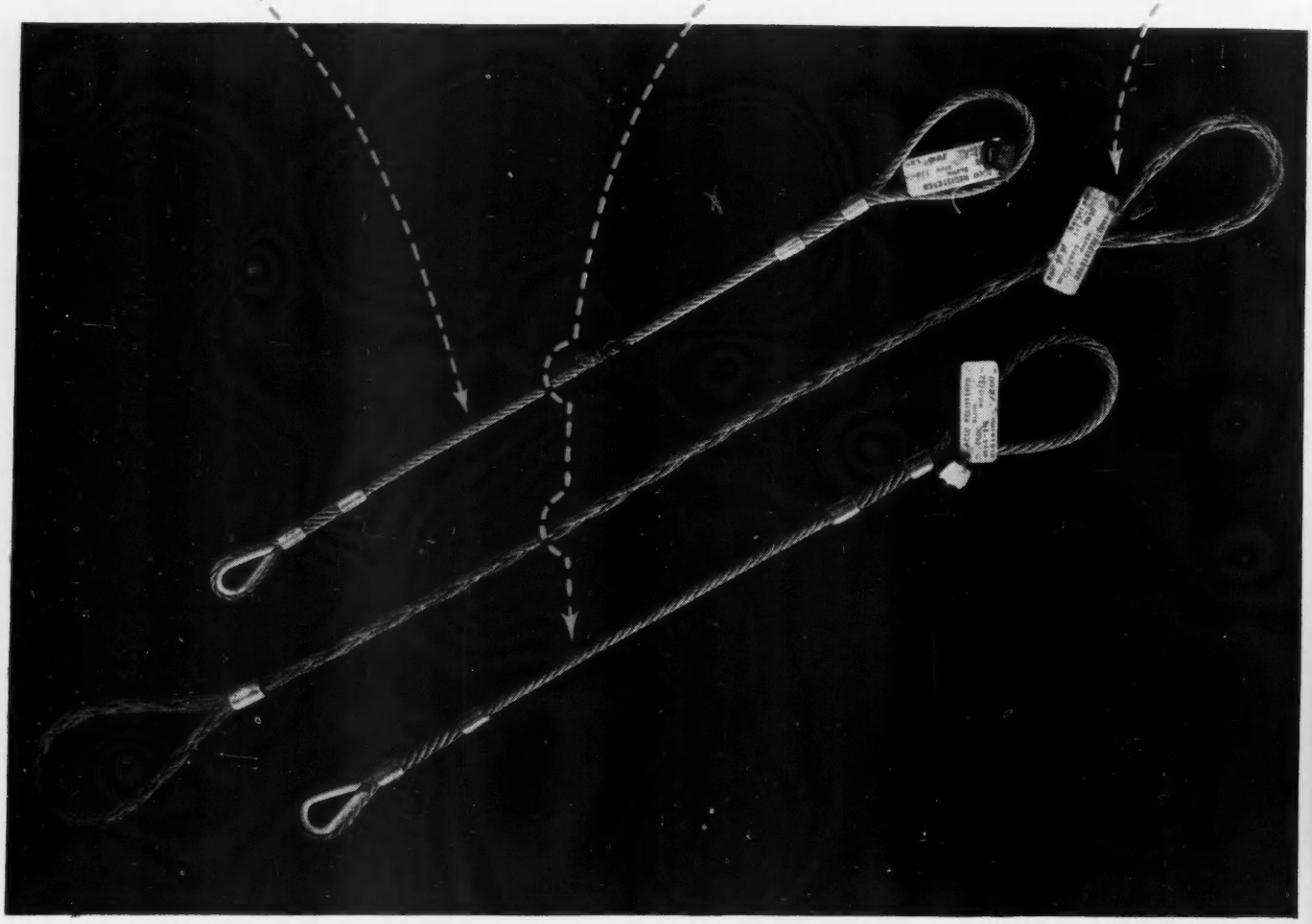
Drilling fast, straight, full gage hole through the stubborn, massive sandstone and limestone formations of the Carboniferous period is better accomplished by HUGHES OWS ROCK BITS! For nearly forty years operators have depended upon the maximum efficiency at minimum cost afforded by HUGHES ROCK BITS in all formations!

Hughes TOOL COMPANY HOUSTON, TEXAS

Standard of the Industry

WHICH SLING?

Strand-Laid? Cable-Laid? Braided?



American Cable has a wider range of sling types than any other manufacturer. Here you can get the exact type of sling best suited to your job. Whether the conventional strand-laid sling, the cable-laid sling, or braided slings made up in 4, 6 and 8 parts, American Cable engineers hold no brief except for the one that will do your job best. And in wire rope endings, too, American Cable takes the lead with the new, 100% efficient ACCO-LOC Safety Splice and the swaged U-LOC. More than this, you may have your American Cable slings proof-tested and registered for known strength and safety. Here again is another sling service that is exclusive with American Chain & Cable. You cannot buy a better sling than an ACCO-Registered sling — made of TRU-LAY Preformed Wire Rope of Improved Plow Steel.

Distributors in all strategic points

ACCO

Wilkes-Barre, Pa, Chicago, Denver, Emlenton, Pa., Houston, Los Angeles, Pittsburgh, San Francisco, Bridgeport, Conn.

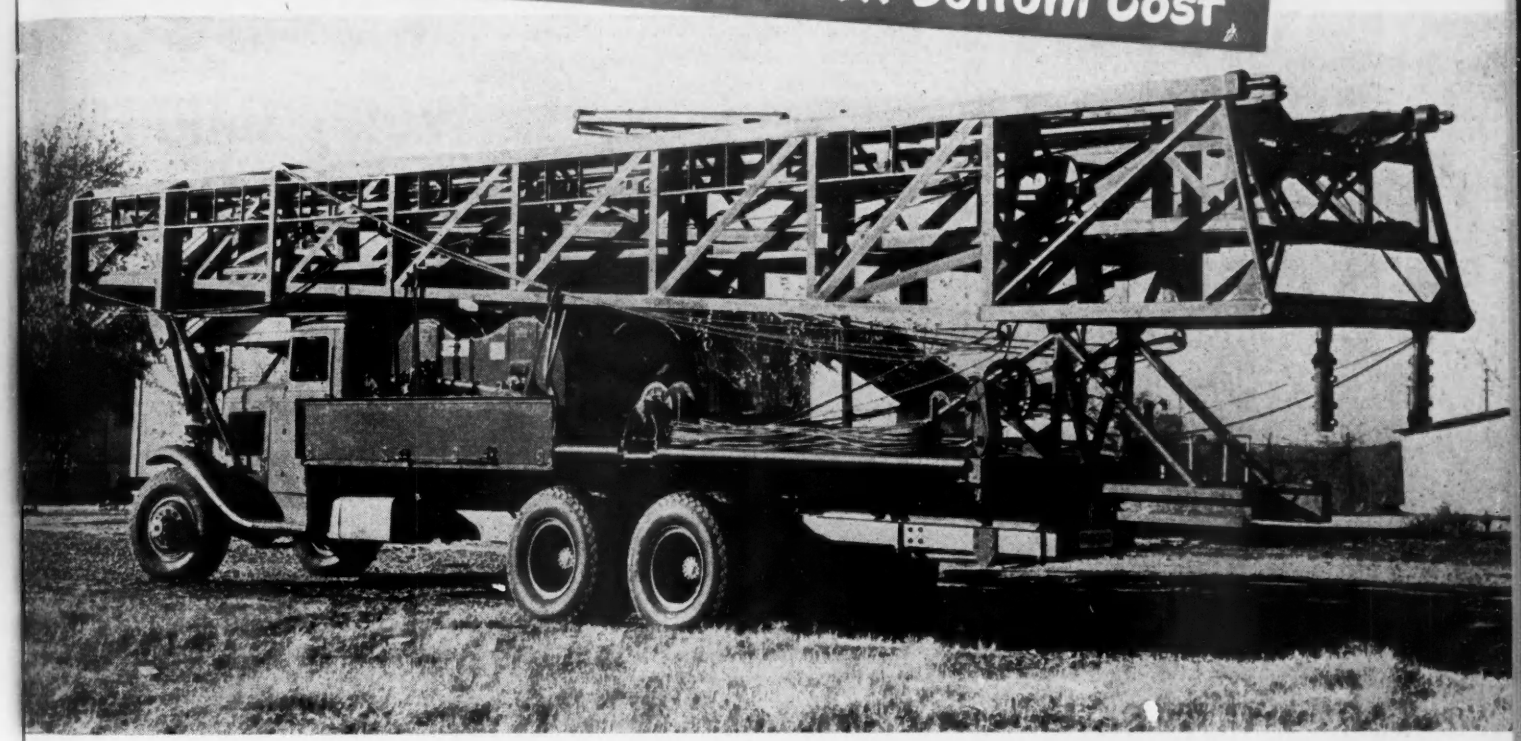
AMERICAN CABLE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

In Business for Your Safety

ALL WHEEL DRIVE

"Moves Peak Pay Loads at Rock Bottom Cost"



The true measure of a truck's value is its ability to transport maximum payloads—*where you want them, when you want them—at minimum cost.* Unless your trucks perform all of these functions, *efficiently, reliably,* they are not giving you full value for your money.

Marmon-Herrington *All-Wheel-Drive* Trucks do give you your full dollar's worth—*because they never let you down. All-Wheel-Drive* power and traction—*front wheels pulling, rear wheels pushing*—guarantee that Marmon-Herringtons will get you there and back—*on time . . . regardless of weather or terrain—on the highway or off.*

Throughout, Marmon-Herrington *All-Wheel-Drive* Trucks are built in proportion to their great power and traction. Frames, axles, springs, transmissions—they're all built super-strong to take peak payloads—without a whimper . . . *and do it for years and years and years.*

Yes, Marmon-Herrington *All-Wheel-Drive* Trucks are built big for big jobs. For a convincing demonstration that these great trucks live up to their reputation—both the Heavy-Duty models and *All-Wheel-Drive* converted Fords—see your nearest Marmon-Herrington dealer, or write for illustrated literature.

MARMON-HERRINGTON COMPANY, INC. • INDIANAPOLIS 7, INDIANA

MARMON-HERRINGTON ALL-WHEEL-DRIVE

GIVE ME A LUFKIN TAPE WITH THE CHROME WHITE LINE THAT IS DURABLE
"ATLAS"
CHROME CLAD
CHROME PLATED STEEL LINE WILL NOT CRACK, CHIP OR PEEL
JET BLACK MARKINGS ON CHROME WHITE SURFACE, EASY TO READ
Lufkin "Atlas" Chrome Clad Oil Gaging Tape. Smooth, rust-resistant chrome offers perfect background for the oil level. Husky reel. Order through your supply house, and write for free catalog.
LUFKIN
THE LUFKIN RULE CO.
SAGINAW, MICHIGAN
New York City

Looking Ahead

WITH THE EDITOR

THE Texas-Louisiana Gulf Coast is one of the most important oil, gas and distillate producing regions in the world. In the past this region has accounted for 10 percent of all oil produced in the U. S. Its proven fields contain 20 percent of the proven reserves in the U. S. today, guaranteeing this region as a producing area for many years to come.

THE OIL WEEKLY of September 16 will present its Texas-Louisiana Gulf Coast issue, the first published since March, 1942. This issue will include thumb-nail sketches of each field in the region, giving location, discovery data, producing formations, daily production, cumulative yields, estimated remaining reserves, number of producing wells, principal leaseholders, and other pertinent data.

In addition, the issue will include as a supplement a map of all the oil and gas fields of the Texas-Louisiana Gulf Coast, reproduced from a large scale map; an article on the Gulf Coast area east of Louisiana to Florida, prepared exclusively for this issue by a prominent Gulf Coast geologist; and articles on Texas-Louisiana Gulf Coast development.

DR. J. BRIAN EBY of Houston, internationally known consulting geologist, has left by plane to make a study of the European oil situation for THE OIL WEEKLY.

It will be the second trip within a year that Dr. Eby has made to Europe for THE OIL WEEKLY. Last fall his survey of the German oil situation was enthusiastically received by our readers

On his trip, he will visit England, France, Egypt and possibly Germany. His articles on the international oil situation will make their appearance the latter part of November.

While in England, he plans to make a thorough analysis of possible effects of the British loan on the United Kingdom in general and the British oil industry in particular.

Leaks

WON'T HAPPEN HERE!

RECTORSEAL-ing the threads on these lines is a guarantee there'll be no connection leaks as long as they are installed. The plastic elasticity of RECTORSEAL positively seals against leaks, even on badly worn or damaged threads.

Developed especially for the Oil Industry, and proved by 8 years of service, RECTORSEAL assures leak-proof connections against high pressures and high temperatures. It is impervious to petroleum fractions, unaffected by oil, gas, dilute acids, salt water. Use RECTORSEAL on all connections to be sure they will be permanently leak-proof.

RECTORSEAL

. . . it's so easy to use!

It can be applied directly from container by brush or swab. Get RECTORSEAL #1 from your supply store and use it on all connections, as they are made. These few pennies for prevention will save dollars in leak repairs.

RECTOR WELL EQUIPMENT CO., Inc.
FORT WORTH, TEXAS
Exports: Lucey Export Corp., Woolworth Bldg., N.Y.C.

RECTORSEAL
THE POSITIVE LEAK PREVENTER

Specialized Oil Publications of
THE GULF PUBLISHING COMPANY
Box 2608, Houston (1), Texas

The OIL WEEKLY and The COMPOSITE CATALOG for the drilling-producing-pipe line industry

PETROLEUM REFINER and The REFINERY CATALOG for the refining-natural gasoline industry

Member Audit Bureau of Circulation and Associated Business Papers, Inc.

EDITORIAL STAFF
WARREN L. BAKER, *Editor*
SILAS B. RAGSDALE, *Managing Editor*
L. J. LOGAN, *Associate Editor*

DISTRICT EDITORS

Washington: Albee Bldg. (5)
BERTRAM F. LINZ

Fort Worth: W. T. Waggoner Bldg. (2)
H. H. KING

New York: 250 Park Ave. (17)
GEORGE O. IVES — HENRY OZANNE

Tulsa: Hunt Bldg. (3)
ANTHONY GIBBON — WILLIAM P. STERNE

Los Angeles: W. W. Wilson Bldg., Huntington Park
GILBERT M. WILSON

Austin: Drawer M., Capitol Station (21)
R. W. BYRAM

Houston: 3301 Buffalo Drive
JAMES S. CRITZ — AL REESE
WELDON B. HILL — J. E. KASTROP
CECIL W. SMITH — C. CLYDE PRYOR

ADVERTISING STAFF
TOM W. NELSON, *Advertising Manager*

New York: 250 Park Ave. (17)
DICK SWINSKY — ROBERT N. CAIRD, JR.
NELSON BIGELOW

Cleveland: 1010 Euclid Ave. (15)
ROGER MOTHERAL

Chicago: 332 S. Michigan Ave. (4)
H. G. FITZPATRICK

Tulsa: Hunt Bldg. (3)
J. F. CARTER, JR.

Los Angeles: W. W. Wilson Bldg., Huntington Park
J. W. CURTS

Houston: 3301 Buffalo Drive (6)
CHARLES WYATT — BILL ATCHESON

CIRCULATION DEPARTMENT
J. HOWARD DONAHUE, *Manager*

Published every Monday. Single copies 25 cents (except special issues). Subscription price: domestic and foreign, $2.00 a year; 2 years, $3.00; 3 years, $4.00. Advertising rates on application. Copyright 1946 by The Gulf Publishing Company.

The OIL WEEKLY

ENGINEERING NEWS STATISTICS

R. L. DUDLEY, President, Publisher A. L. BURNS, General Manager

Contents

SEPTEMBER 9, 1946

VOLUME 123, No. 2

Technical and Feature Articles

SHALE OIL EXPERIMENT 33

MISSOURI—ITS OIL AND GAS POSSIBILITIES 34
By Frank C. Greene

FUNDAMENTALS OF INDUSTRIAL ACCIDENT PREVENTION, PART 6 37
By C. L. Hightower

GEOLOGY APPLIED TO PETROLEUM, PART 4 39
By Vincent C. Illing

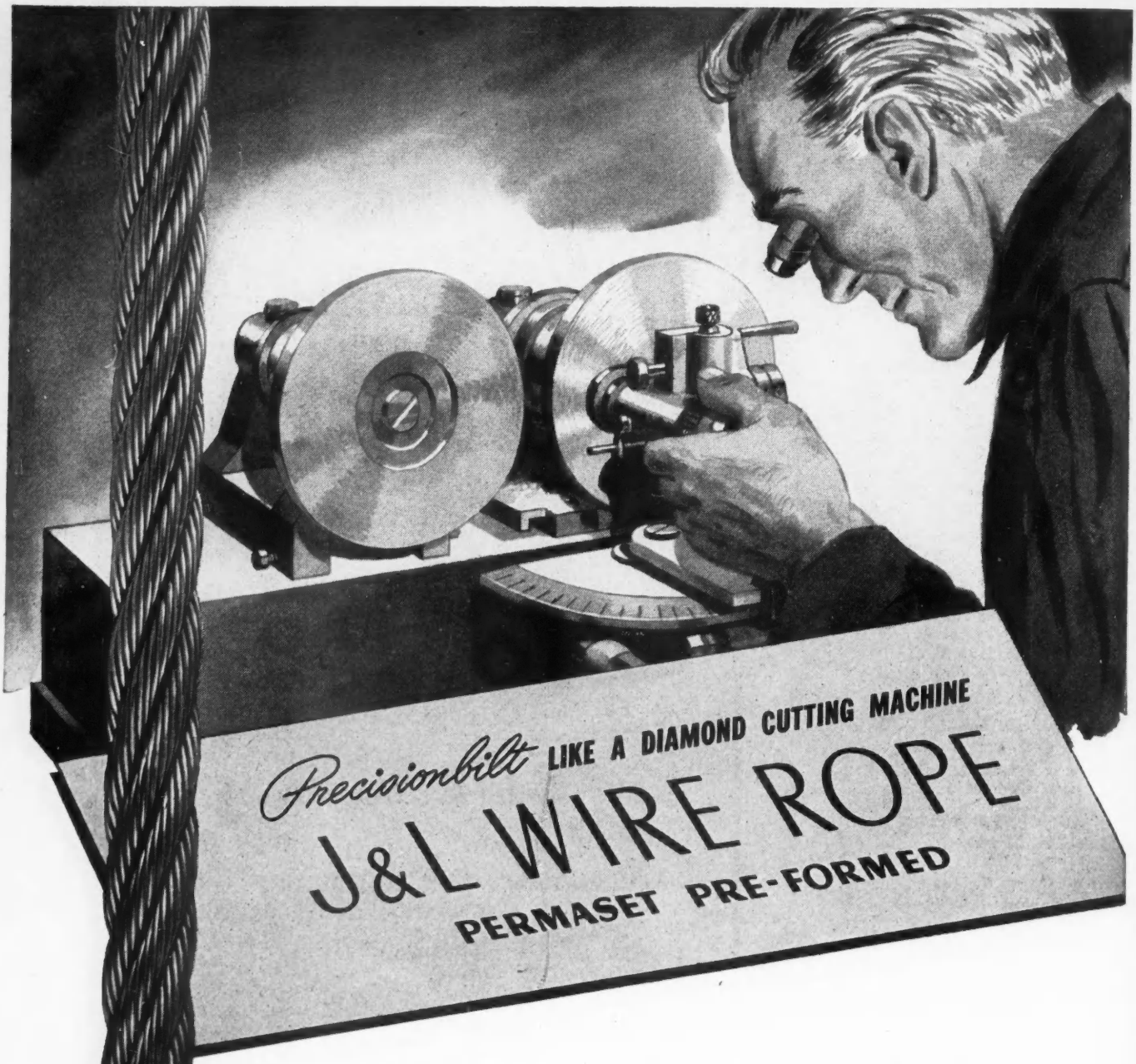
MATHEMATICAL METHODS OF DECLINE CURVE EXTRAPOLATION AND RESERVE CALCULATION 45
By Sylvain J. Pirson

BIG SLUSH PUMP 58
By J. E. Kastrop

DRILLING HINTS 60

News and Departments

LOOKING AHEAD 18
THE OUTLOOK 23
THE CHANGING PANORAMA 25
THE WEEK'S NEWS 27
CRUDE PRODUCTION 29
PIPE LINE NEWS 31
INTERNATIONAL NEWS 32
NEW EQUIPMENT, LITERATURE 65
MARKET TRENDS 68
FIELD OPERATIONS 71
THE OIL MAN'S CALENDAR 72
EXPLORATORY COMPLETIONS 87
WILDCAT STARTS 89
SQUEAKS FROM THE BULL WHEEL 91
MEN IN THE INDUSTRY NEWS 92
BOOK REVIEW 94
MANUFACTURERS' NOTES 95
ADVERTISERS' INDEX 96



Precisionbilt, like a diamond cutting machine, J&L Permaset Pre-formed Wire Rope will give you increased rope life. Just as diamond cutting is done by highly skilled men of long experience, J&L Wire Rope is made by men who have for years produced the best in wire rope.

The long service of J&L Wire Rope on any job reflects the quality of the steel from which it is made—J&L Controlled Quality Steel.

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION

GILMORE WIRE ROPE DIVISION

PITTSBURGH 30, PENNSYLVANIA

J&L *Precisionbilt* PERMASET PRE-FORMED WIRE ROPE

THE CHANGING Panorama

An Anticlimax to Oil Shortage Talk

OIL industry spokesmen have publicly expressed strong disagreement with U. S. Department of State representatives who recently broadcast views that America in 20 years will have to import half its oil needs and therefore America should promote international oil agreements under United Nations control.

Eugene Holman, president of Standard Oil Company (New Jersey), largest U. S. oil company, in a broadcast, declared it could be expected that U. S. reserves would be as great 20 years from now as they are at present; that new discoveries and limited imports will equal consumption during the period; and that there will be no actual shortage for generations because liquid fuels will be made from oil shales and coal when the need arises. "Coal alone offers an almost inexhaustible domestic source of oil products," he asserted.

J. Howard Pew, president of Sun Oil Company, pointed out that numerous past predictions of oil shortages, some by able geologists, had all failed to come true, and said most of the predictions, including those of today, are predicted on the condition, "if we do not discover more oil." To debate on what to do if no more oil is found, he said, is like figuring on what to do if the sun fails to come up tomorrow, which only simpletons would do. Pew declared that oil should not be singled out from other strategic materials for international control; that it could be covered by general treaties of amity and commerce; that American oil men want no special privileges in foreign lands but neither do they want to be subjected to superstate cartels, which is the direction in which these international negotiations inevitably go. No proposal yet advanced for international action would add a barrel of oil to our resources for national defense when the need arises, he declared.

Sun Oil Company's public relations department also issued a press release pointing out that U. S. proved reserves are now at the highest level in history; that they increased steadily even under wartime handicaps; that shortage scares of the past all proved groundless; that vast reserves of crude oil await discovery in the U. S.; and that oil shales and coal will furnish billions of barrels of liquid fuels when needed.

As an anticlimax to all this discussion of what we will do about avoiding a shortage of oil, H. B. Fell, executive vice president of the Independent Petroleum Association of America, and vice chairman of the association's committee on balance of supply with demand, warned that production currently is dangerously exceeding consumptive demand. Waste is being promoted, he declared, by over-building of above-ground stocks. Total stocks of all oils increased at an average rate of 407,000 barrels per day for the five weeks ending August 24, he said. "We can afford to use but not to waste our natural petroleum resources, through unnecessary above-ground stocks, which create waste," he declared.

"During the first year since V-J day total above-ground stocks have increased about 37,000,000 barrels notwithstanding the fact that demand has declined," Fell stated. "Most of this increase, in fact about 22,000,000 barrels of it, has occurred during the three months ending August 24, 1946. Stock levels were low at the close of the war and some increases were justified but stocks have recently been increasing to unnecessary and therefore wasteful levels."

On the basis of imports as in the first half of this year and no change in stocks, said Fell, consumptive demand for domestic crude in the third quarter was estimated at 4,600,000 barrels daily, whereas domestic production now is actually around 4,843,000 barrels per day. To restore balance between production and demand and to liquidate excess stocks accumulated in the third quarter, said Fell, domestic production should be reduced 300,000 barrels per day; or importers should lower their imports 120,000 barrels daily (to levels of NRA days), in which case a cut of 180,000 barrels per day in domestic production would suffice.

Texas Exemplifies Oil's Tax Load

TEXAS Mid-Continent Oil and Gas Association has performed another service to the oil industry in its current (seventh) edition of "Important Facts About Texas Oil and Gas."

If it contained nothing else of value, the presentation of tax matters alone would justify the time and expense involved.

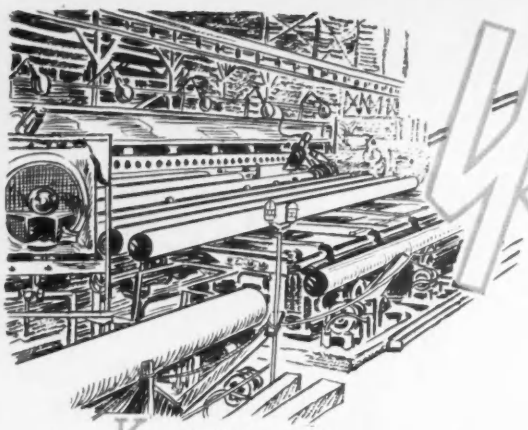
A likely eye-opener, for example, is the fact that in Texas the petroleum industry in 1945 paid 52.2 percent of all state business and property taxes, or a total of $62 million of the state's $118.8 million total. This is exclusive of taxes passed on to consumers and in 1945 the motor fuel tax alone amounted to more than $43 million.

Despite such facts, we witnessed not long since, a gubernatorial candidate whose platform's main plank was heavier taxation on oil, gas and sulphur. Fortunately, the people of Texas showed their good judgment by declining his leadership with a 2 to 1 vote.

* * *

Management's wings have been clipped and to such extent that our national economic pace has been sadly slackened and we can no longer hope to soar to new heights of accomplishment unless we permit its wings to grow again.

—THE IRON AGE

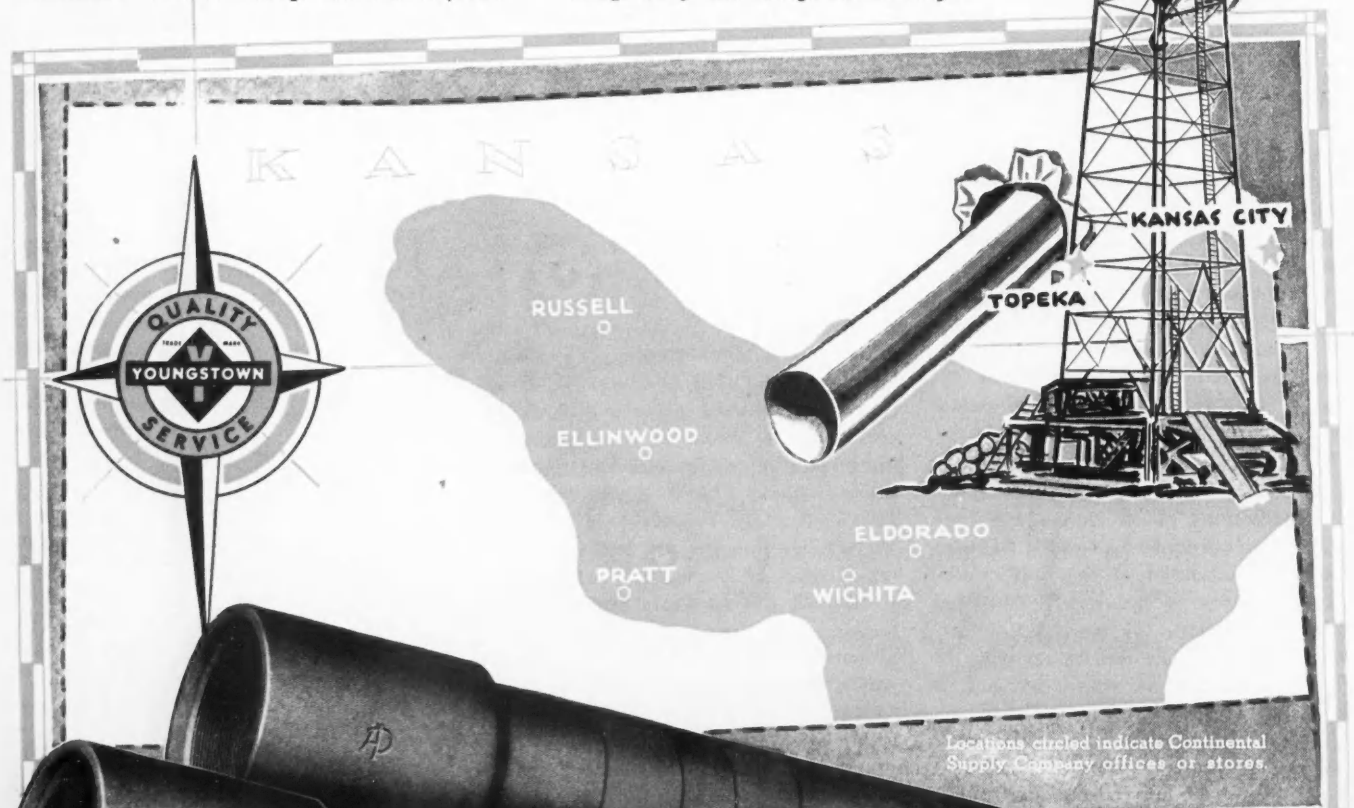


Youngstown to KANSAS

KANSAS has been an important oil and gas producing state for nearly half a century. In fact, it was the year Youngstown rolled its first oil country tubular goods--1903 --that the Sunflower State first approached a million barrels of crude production.

In its all-time output of oil, Kansas ranks fifth among the states--fifth also in 1945 production. Proven reserves have fallen somewhat during the war years, but more wells are forecast for the future and footage to be drilled is on the increase. Kansas is not a deep well state, but the drilling trend is to lower horizons, with a new depth record of nearly 8,000 feet in Meade County last year.

For over 40 years Kansas operators have found that Youngstown Oil Country Tubular Goods have the sturdiness and built in quality to meet all the exacting demands of Mid-Continent drilling and production. Here as in other areas, oil men are able to depend on Youngstown drill pipe, casing, tubing and line pipe for good performance, whether service conditions are corrosive or normal. Through long experience they have come to recognize the orange bands as the mark of quality and dependability.



Identify Youngstown Oil Country Tubular Goods by the orange band or bands.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

Export Offices - 500 Fifth Avenue, New York City

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products-Sheets-Plates-Conduit-Bars-Coke Tin Plate-Electrolytic Tin Plate-Rods-Wire-Cold Drawn Carbon Steel Rounds - Tie Plates and Spikes.

The Week's News

A CONTRACT more favorable to Standard Oil Company of California will be recommended today before the Naval Affairs Committee. Story below.

Mead Report on Oil—Government participation in development of foreign oil resources as insurance against a lack of petroleum in the event of another war is recommended by the Mead committee investigating the national defense, in a report which also again assails the Canol project and other shortcomings in the war effort. Page 28.

Mother Hubbard Delay—The Department of Justics foresees extensive legal maneuvering which will delay trial of its "Mother Hubbard" suit against the industry for twelve months or more. API may be dismissed as a defendant, but the line-up otherwise will remain practically as it is now. Page 30.

Demand and Supply—IPAA executive vice president H. B. Fell calls for reduction of 300,000 barrels daily in domestic crude supply and calls upon importers to cut the movement of foreign oil by 120,000 barrels daily to protect producers' allowables. Page 25.

Big Inch Proposals—War Assets Administration has made a final call on bidders for the Big Inch pipe lines to submit supporting data, and may reach a decision on the sale or lease of the lines this month. Page 29.

Russia's Plans for Baku—Russia's current five-year plan contemplates boosting Baku production to 123 million barrels yearly by 1950, calling for construction of Europe's second largest hydroelectric plant to supply power to fields. Page 32.

NPC Meeting Soon—Members of the organizing committee of the National Petroleum Council have been called to meet in Washington September 24 to review their work and prepare a formal report for submission at the next council session two days later. Page 30.

Anglo-American Pact Muddied—Adverse reaction from the oil industry to the State Department oil broadcast, it is feared, will handicap ratification of the Anglo-American oil pact, due to be pressed in January. Story below.

September Demand—An increase of 16,000 barrels daily during September over August figures is forecast by the Bureau of Mines. Page 29.

OPA Preparedness for Oil—OPA is not materially reducing personnel in divisions handling important commodities, such as oil, which at present are "decontrolled." Page 30.

Draft Deferment—Details of how to go about getting occupational deferment from selective service outlined by Interior Department. Page 30.

State Department Busy Explaining Implications Affecting Oil Treaty

Proposals to negotiate a multi-lateral oil agreement providing for the consideration of international oil problems by the United Nations Economic and Social Council were explained by State Department officials last week to be nothing more than an extension of the Anglo-American petroleum agreement, which they said will be pressed for ratification by the Senate in January.

As a result of the manner in which the proposal was made public in a nationwide broadcast August 17, however, the Department already has encountered a storm of opposition from the oil industry which may spill over against the Anglo-American agreement. To an unfortunate choice of terms and the use of words in a sense different from what they mean to oil men was attributed the quick adverse reaction from the industry.

Spokesmen for the Department denied implications in the broadcast that the United Nations would have mandatory powers with respect of oil. In fact, it was declared, no decision has been reached to have oil questions go to the Economic and Social Council, and that set up was merely suggested as a logical place to which such problems could be referred. The same results could be achieved, it was pointed out, by a committee or commission set up among the signatories to a multi-lateral oil pact.

The proposal for a multi-lateral treaty is based upon the Anglo-American agreement itself, which is merely an interim arrangement and calls for participation in a wider agreement by all interested nations which produce or consume oil, they said.

Department officials involved in international oil matters are firmly behind the idea that any agreement made must be wholly voluntary, that there must be no compulsion and no mandatory enforcement, and that it must have the full support of the industry and the governments involved.

Unless there is some body before which the problems that arise in regard to concession contracts can be threshed out in an attempt to arrive at a satisfactory conclusion, it was held, we will have the same situation as in the past, of confiscation or abrogation of contract simply because neither side has a forum before which it can talk.

But, it was emphasized, it is not intended that any such body should have the power to dictate what should be done, but mostly the authority to recommend what might be done to remedy the situation amicably.

Revision of Elk Hills Contract Is Recommended

Vice President F. S. Bryant of Standard Oil Company of California and Navy officials will join today in laying before the House Naval Affairs Committee a recommendation for revision of the Elk Hills contract to provide that the Navy shall pay its share of the cost of maintaining the reserve constantly ready.

Under the unit plan contract entered into in 1944, Standard is required to pay the cost of producing the oil it receives and the full cost of the readiness program, the latter amounting to about $600,000 a year. The contract modification will provide that the Navy shall stand two-thirds of that cost.

Failing to get Navy participation in bearing the extra expense on the basis of its relative holdings of oil, Bryant said, the company may find it necessary to cut down its own production to a point which will cover merely its share of costs plus taxes, necessitating the production of Navy oil. Present production is 8450 barrels daily which is charged against Standard's one-third of the oil in the reserve.

The committee also will receive a recommendation from its own counsel, that the limitation of 25 million barrels to be withdrawn by Standard be eliminated and the maximum be placed at one-third. The present limitation was based on a figure of 75 million barrels as Standard's third of the reserve but an engineers' report to the Navy two years ago placed the company's holdings at about 103 million barrels.

The purpose of this modification of the contract will be to make it unnecessary to bring the matter up again for several years. Under the 25 million barrel limitation the company will reach its maximum permissible withdrawal within 30 months to three years, it is estimated, while the additional 9 million barrels which would be permitted under the higher figure would permit operation for several years longer.

MER Changes Asked

Substantial changes in producing rates were recommended for seven fields last week when the Texas Railroad Commission held its MER hearing on North Texas District 9. Fields in which these changes would be effected are the Hull-Silk-Sikes, Walnut Bend Winger, Dodson, Ringgold, K.M.A., K.M.A. Ellenberger, and West.

Mead Group Recommends Government Aid in Developing Foreign Reserves

Government assistance in development of foreign petroleum reserves, to assure the United States of enough oil for another war, was recommended last week by the Mead Senate committee investigating the national defense program.

The recommendation was one of a number voiced in the fifth annual report of the committee formerly headed by President Truman, in which also the spectacularly unfruitful Canol project was characterized as "waste of a type that if accomplished by a saboteur would have resulted in execution."

Canol, however, was only one of a number of shortcomings in the war effort criticised in the report, several of which were early apparent to members of the oil industry who sought to supply the products needed for military operations while at the same time keeping the domestic economy rolling.

The committee charged that the Army and Navy never put into effect the industrial mobilization plan on which they worked for 20 years prior to the war.

It charged, too, that government production controls, although frequently successful, were confusing and often resulted in duplication and inefficiency, and that the War Production Board was hampered in its efforts to mobilize and control industry "through interference by military procurement officers, and by the conflicts existing between the independent administrators who were put in charge of oil, coal, transportation and other aspects of the war program."

Ran Roughshod

Further, it asserted, not until the very last months of the war did the WPB have any control over the War Department and the Navy Department, "both of which ran roughshod over the entire war production program, pre-empting materials, changing production schedules from day to day and setting up facilities without regard to the obvious fact that the things they were accomplishing would be entirely useless unless in balance with the portions of the program in which they showed little interest, since these portions were outside of the military jurisdiction."

So bitter were the inter-agency controversies, the report commented, that "at one point the Undersecretary of War, the Rubber Director, the Undersecretary of the Navy and the Petroleum Administrator reached such a violent impasse that they offered to air their differences before this committee and succeeded in reconciling them only after a public exhibition of the lack of coordination among them."

Demanding that steps be taken to prevent a recurrence of such situations, the committee at several points in its report stressed the situation with respect to oil.

"More businesslike administrative methods in the armed forces during the emergency would have brought the war to a victorious conclusion at an earlier date, with less cost in life, dollars and natural resources," it declared.

Cost Of Raw Materials

"No nation, including our own, is self-sufficient in the basic raw materials needed to produce the equipment and weapons necessary to fight a modern war. Although the United States has been the most energetic and vigorous nation in exploiting and developing raw materials, we are not necessarily the richest in natural resources. It is not possible to replace from within our own borders the rich store of materials that we provided for ourselves and our allies during the war.

"The greatest cost of World War II, of course, was the loss of life and the maiming and crippling of those who served in the armed forces. But second only to that, the greatest cost of war was the depletion of our richest supplies of raw materials. The very energy and ingenuity we have displayed in developing and exploiting our natural resources resulted in the expending of enormous qauntities of materials. This means that we cannot count on raw material supremacy against all possible combinations of enemies. In the future other nations may be developing and exploiting huge natural resources at a time when our richest supplies have been seriously depleted.

"In February, 1944, the committee reported on petroleum matters to the Senate, urging that the security of the United States was dependent of adequate supplies of petroleum and noting that our domestic supply was diminishing to an alarming degree. It urged that proper provision for adequate petroleum supplies from sources abroad should be made and particularly referred to the importance of the Persian Gulf area in connection with this recommendation. Recently, these warnings by the committee have been supported by a statement by the Secretary of the Interior, J. A. Krug. Former Secretary of the Interior Harold L. Ickes likewise was of the opinion that we could not 'oil another war' from our own sources. *The government cannot, as a matter of national defense, afford to leave to private oil interests the sole responsibility of assuring adequate petroleum supplies.*"

Canol Called a Blot

Commenting that "some officers in important instances stubbornly refused to admit mistakes and required the continuance of projects and programs which resulted in enormous waste of manpower and critically short materials," the committee charged that $135 million was spent on Canol "based on a wholly inadequate study by a part-time dollar-a-year consultant and a one-page report containing no facts and only recommendations."

It held that the prime movers in the project were Lieutenant General Brehon B. Somervell, head of the Services of Supply, and Admiral Ernest King, Chief of Staff of the Navy, both now retired, and declared "this action constitutes a blot upon the record of two otherwise capable officers, which it is the duty of the committee to report and comment on to the end that there shall be in the future no recurrence of a similar type of action."

The report pointed out that the War Department insisted on continuing Canol, even after an inter-agency meeting at which the Secretary of the Navy, the Petroleum Administrator and the WPB chairman and their advisors unanimously concluded it was not worth completing, and said efforts of the committee to investigate it were thwarted by King's insistance that the decision has been reached "on the basis of secret information and on the basis of future military operations so secret in character that it would be seriously detrimental to the war effort for a committee of the United States Senate to possess such information."

King, it was charged, "as a member of the Joint Chiefs of Staff, differed with the official position of the Navy as expressed by the Secretary of the Navy, and used the high office of the Joint Chiefs of Staff and the claim of military secrecy for the purpose of preventing the Congress and the people from requiring the discontinuance of a costly blunder by a fellow officer who was unwilling to admit his mistake and who was stubbornly insistent upon completing a project regardless of the cost in manpower and critical materials."

Even after his retirement King refused to break the seal of silence, the committee added. (Following publication of the report, King protested, declaring he merely "authenticated" acts of the Joint Chiefs of Staff. He has been offered an opportunity by Chairman Mead to appear before the committee if he desires to make a further explanation.)

Canol's Results

Total results of the Canol project, the committee found, were the production of 23,417 barrels of aviation gasoline, the equivalent of one-fourth of a standard tanker load: 31,370 barrels of motor gasoline, equivalent to one-third of a tanker, and 256,358 barrels of diesel oil, the equivalent of three tankers. On a 30-day turnaround, it declared, a single tanker, in the three years needed to complete the project, could have delivered twelve times as much products.

So far as salvage value is concerned, it was pointed out, "the Foreign Liquidation Commission has reported that competent military authorities in both the United States and Canada consider the refinery and oil pipe-line system of questionable value 'even in the event of another emergency.'"

President Truman on September 5 said what he apparently hoped would be the last word on Canol—that it was a dead horse, had been investigated fully by the committee when he was its chairman, and it would do no good to dig it up again because it had been disposed of.

September Demand Figure Jumps Only 16,000 Barrels Daily, Bureau Reports

Demand for domestic crude this month will require the production of 4,790,000 barrels daily, an increase of 16,000 barrels a day over August, the Bureau of Mines forecast last week.

Production rates in eight states are up and two down, the Bureau Recommended. Demand for Texas oil will remain unchanged from the August level of 2,120,000 barrels daily.

The Bureau found that the actual demand for domestic crude in the second quarter was 4,766,000 barrels daily, about 212,000 barrels above the first three months of the year, and current data indicates that demand in July was 4,875,000 barrels daily and in August 4,820,000 barrels, while demand for the third quartre as a whole is forecast at 4,771,000 barrels daily. However, the Bureau said, actual demand may exceed that forecast by about 1 percent, but will involve a larger seasonal increase in refined stocks, particularly distillate fuel oil and kerosine, than was anticipated.

"Sufficient data are not yet available to show a detailed analysis of the major products in connection with the revised forecast for 1946 that was published in the August forecast," the bureau reported. "Preliminary demand for motor fuel indicates that total demand will approximate the estimate of 209,000,000 barrels for the third quarter and that an excess over previous forecasts can be attributed to automotive use.

"The total demand for distillate fuel oils in the third quarter may be from one to two million barrels less than was forecast, the decline being in civilian demand and due, at least in part, to advance seasonal stocking by distributors and consumers in the second quarter. From present indications, the stocks of distillate fuel oil may increase by about 16,000,000 barrels in the third quarter.

"The total demand for residual fuel oil in the third quarter may be about 2,000,000 barrels less than was forecast, with a sharp decline in military purchases and a substantial gain in estimated civilian consumption. Even though the total demand for residual fuel oil should prove to be less than forecast for the balance of 1946, a further substantial rebuilding of depleted stocks might be considered as essential."

In its forecast for September, the Bureau estimated increases in production in California to 855,000 barrels daily from 850,000 barrels in August; Oklahoma, 386,000 from 384,000; Louisiana, 384,000 from 380,000; Kansas, 264,000 from 260,000; New Mexico, 100,000 from 99,000; Mississippi, 61,000 from 60,000; Pennsylvania, 35,000 from 34,000, and Colorado, 31,000 from 30,000, with reductions in Illinois to 214,000 barrels from 215,000, and Wyoming, 108,000 from 110,000.

This would leave unchanged, in addition to Texas, Arkansas, 78,000 barrels; Michigan, 47,000; Kentucky, 31,000; Montana, 24,000; Indiana, 19,000; New York, 14,000; West Virginia, 8400; Ohio, 7600; Nebraska, 800, and others, 2200.

Crude Production in the U. S.

(Estimates compiled by THE OIL WEEKLY. All figures indicate daily averages in barrels.)

STATE OR DISTRICT	PRODUCTION IN WEEK ENDED Sept. 7	Aug. 31
Alabama	1,150	1,100
Arkansas	73,750	74,200
California	869,000	874,100
Colorado	38,300	37,000
Florida	100	150
Illinois	208,600	209,300
Indiana	18,950	18,000
Kansas	279,550	279,550
Kentucky	30,700	30,700
Louisiana	389,850	387,950
North Louisiana	85,950	84,150
South Louisiana	303,900	303,800
Michigan	46,900	46,850
Mississippi	73,050	72,500
Missouri	100	100
Montana	24,800	25,500
Nebraska	700	700
New Mexico	100,650	100,900
New York	14,185	14,100
Ohio	7,550	8,000
Oklahoma	384,200	385,500
Pennsylvania	37,315	36,900
Tennessee	35	35
Texas	2,092,700	2,119,800
Tex. R. R. Comm. Districts:		
District 1—S. Central	19,400	19,500
District 2—Lower Gulf Coast	149,300	155,100
District 3—Upper Gulf Coast	467,950	486,550
District 4—S. West	220,500	224,300
District 5—E. Central	41,300	43,050
District 6—E. Texas Field	324,700	317,000
District 6—Rest of N. East	103,900	105,650
District 7-B—W. Central	32,800	32,650
District 7-C—West	27,250	27,900
District 8—West	491,050	490,600
District 9—N. Central	129,550	132,700
District—10 Panhandle	85,000	84,800
West Virginia	7,650	7,700
Wyoming	105,500	112,800
Total United States	4,805,285	4,843,435

Total stocks, foreign and domestic August 31, as reported by the Bureau of Mines were 227,132,000 barrels with a daily average production of 4,833,000 barrels and runs to stills 4,911,000.

Two or Three Big Inch Bidders Seem Favorites

All bidders for the Big and Little Big Inch pipe lines were asked last week immediately to submit exhibits substantiating their proposals with WAA indicating that a decision will be made shortly after the middle of the month.

WAA officials explained that while some bidders voluntarily submitted data in support of their offers, not all did so and it was decided to ask that all bidders make their "strongest showing" on their proposals, pointing out that "it is incumbent upon the bidder to exercise diligence in making his proposal as firm as possible.

While WAA has maintained silence regarding the results of an analysis of the 16 proposals received July 31, it is understood the field has narrowed down to two or three bidders, all of whom contemplate use of the lines for natural gas, either immediately or alternatively.

Pennsylvania Grade Oil Price Is Increased Again

For the third time within 5 months, posted prices of Pennsylvania grade crude oil were increased effective generally September 1. The new increases ranged from 6 cents a barrel on Bradford oil to 26 cents on Eureka and Buckeye grades. These raises were in addition to increases of 10 cents April 1 and 25 cents August 1. However, under the government policy of reducing subsidies by the amounts of increases in posted prices, realization for producers is not expected to be affected.

The new increases have been construed as reflecting keen competition among purchasers for sources of supply. And it has been predicted that posted prices may rise by next spring to the full amount of present postings plus subsidies and possibly higher. After subsidies have lapsed, it is forecast, purchasers will have to pay higher prices in competing for available crude.

Bradford-Allegany crude was raised 6 cents a barrel effective September 1 to $3.41 per barrel. Other new prices include the following: Pennsylvania grade in Southwest Pennsylvania lines of the Joseph Seep Purchasing Agency of South Penn Oil Company, $3.20 a barrel, up 20 cents; Pennsylvania grade in Seep's Eureka lines, West Virginia, $3.20 up 26 cents; Pennsylvania grade in Seep's Buckeye lines, Ohio, $3.16, up 26 cents; Cabin Creek and Kelly Creek, West Virginia, in Pure Oil Company's lines, $3.20 per barrel; all these postings effective September 1. The increase to $3.20 for Eureka, West Virginia, crude was initiated by Elk Refining Company, effective September 1, and was met promptly by most other purchasers.

Five New Wells in Japan Bring Increased Output

Japanese crude production increased from about 4100 to 4350 kiloliters (25,000 to 27,000 barrels) per week between January and July and five new wells in Akita and Niigata prefectures recently brought in are expected to boost production by another 10 percent, a report on Japanese non-military operations by General MacArthur discloses.

MacArthur reported that the financial situation of Imperial Oil Company, responsible for 95 percent of Japanese crude production, is serious because of the loss of the production subsidy. A tentative settlement of 18 million yen by the government is being considered but this still leaves a loss of 16 million yen.

Ralph McIntyre New Head Of Standard of Texas

Ralph G. McIntyre of El Paso, Texas, was elected president of the Standard Oil Company of Texas succeeding the late A. J. Cunningham, last week at a meeting of directors in San Francisco.

Three Houstonians, named directors, are J. P. Fox, vice president in charge of exploration; C. W. Reith, vice president in charge of production, and Hubert L. Smith, secretary-treasurer.

Year's Delay or Longer in Prospect Before "Mother Hubbard" Trial Starts

With progress in the government's "Mother Hubbard" suit against the oil industry slowed down to a walk, trial of the case is unlikely for at least a year and it may possibly be 1948 before taking of testimony begins.

Department of Justice officials maintain their intention of pressing the case, but foresee many delays in getting it under way. How slowly the suit is moving is indicated by the fact that while the department sought to get the defendants into court last spring, several months were lost in fruitless efforts to negotiate a consent decree, and it was not until July that the companies filed their answers.

With one exception, the company answered none of the government's allegations but, instead, asked for a bill of particulars, the preparation of which would be a tremendous task since the department would have to detail every individual charge against every individual defendant.

The department next month will file its response to that request, opposing a bill of particulars, and the defendants then will seek permission to file additional matter, and so on. Eventually, the court will hear argument and pass on the motion and, if it rules in favor of the defendants, which is quite likely, more months will elapse while the department works on its bill.

If the government is required to specify in detail each charge against each defendant, it is considered likely that the American Petroleum Institute will be dismissed from the case since, while the general charges in the government's complaint can be extended to cover the API, it is believed only a few minor charges could be made against it specifically.

OPA Maintains Personnel In Event Decontrol Lifted

Acting on the theory of preparedness, OPA is not materially reducing personnel in divisions handling important commodities which have been decontrolled, but is maintaining a force adequate for immediate full operation should any commodity, oil for instance, be put back under control. J. H. Reppert, acting director of the fuel price branch, has a force of undisclosed size which is mainly occupied with the compilation of current statistics of price movements and production.

OPA officials are far from certain that commodities now being decontrolled will experience an orderly price position as the general level of prices moves upward. Reppert and other officials have made it clear that they do not accept oil decontrol as irrevocable and have also emphasized that if prices show signs of sky-rocketing they will not hesitate to ask the price decontrol board to clamp down. They have not indicated what they considered would constitute an unreasonable increase in oil prices, but it is quite possible that if crude prices were to advance even another 10 cents, paving the way for total elimination of subsidies except for Pennsylvania-grade oil,' the decontrol board would be asked to investigate the situation, although it is generally believed OPA could not show that the resulting increases in product prices seriously affected the cost of living, nor that there was a shortage of supply, two of the three criteria to be met in restoring control.

Survey and Land Bureau's Duties on Leasing Outlined

New regulations, defining the responsibilities of the U. S. Geological Survey and the new Bureau of Land Management with respect to leases on the public lands have been issued by the Interior Department.

They provide that the Geological Survey shall determine whether an applicant for the 12½ percent royalty benefit provided under the O'Mahoney act of 1942 has actually made a discovery and after a report from the Bureau of Land Management on the lease, lessee and operator, shall grant or reject such application.

The Bureau of Land Management will act upon applications for renewals and exchanges of leases, on the basis of reports from the Geological Survey. The only cases in which the Bureau will not act finally upon its own initiative are those where the effect of an exchange of leases would be to reduce the current royalty values more than 20 percent, in which event a report is to be made to the Secretary, showing all facts which might be of importance in determining whether the exchange would be to the advantage of the United States and containing a recommendation of the action to be taken, and the final decision is to be made by the Secretary.

Texas Water-Flood Work Is Described in Bulletin

Water injection operations in eight Texas counties since 1936 have resulted in the recovery of 1,141,000 barrels of oil without drawing on new reserves, the Bureau of Mines has reported.

These operations, limited largely to the old shallow fields in North Central Texas and centering mainly in the Burkburnett-Wichita Falls and the Olney-Prideaux districts, involved the injection of 12 million barrels of water, the recovery representing about 579 barrels of oil per acre in the 1970 acres under development.

Details of the 38 water-flooding projects undertaken beginning in December, 1936, are given in a report published by the Bureau, copies of which may be obtained without charge.

Draft Deferment Plan For Industry Outlined

Research personnel in the petroleum industry has been divided into two classes for purposes of certification for occupational deferment from the draft, the Interior Department has announced.

Technical or scientific personnel whose activities are concerned primarily with research for the improvement or further development of presently known processes will be passed on by the office of labor requirements of the Civilian Production Administration, with the Oil and Gas Division acting in an advisory capacity.

Similar personnel engaged in industrial or foundational research, either in the physical sciences or engineering, including development of entirely new processes, will be reviewed by the Office of Scientific Research and Development.

In cases where an individual receives an induction notice before action has been taken by the CPA, he or his company should telegraph the certifying agency, and the Oil and Gas Division if desired, stating the date he is to report for induction, and every effort will be made to expedite such cases.

It was emphasized that applications for deferment should be supported by complete information on the registrant's work, experience and educational background and his present position, and a showing of the relationship between his work and reconversion and the probable effect of the loss of his services upon the company's output.

Organizing Committee of NPC to Meet in Advance

Members of the organizing committee of the National Petroleum Council have been summoned by Temporary Chairman Walter S. Hallanan to meet in Washington September 24, two days in advance of the council meeting at the Interior Department, to discuss their reports and draft a formal report to be submitted September 26.

The meeting was called two days in advance so that members who desire to attend the meeting of the American Petroleum Institute directors in New York September 25 will have an opportunity to do so.

For the past two months the committee has been engaged in developing recommendations regarding the type of organization to be adopted by the council, together with its authority and functions.

NGAA Picks Dallas

The 26th Annual Convention of the Natural Gasoline Association of America will be held April 23-24-25, 1947, in Dallas instead of Tulsa as was first announced.

William F. Lowe, NGAA secretary, said the meeting originally was scheduled to be held in Tulsa immediately preceding the International Petroleum Exposition, but NGAA directors decided on a return to Dallas next year after announcement was made that the Exposition had been postponed.

Cooperatives to Enter Permian Basin With Line Originating in New Mexico

Entry of Middle-Western cooperative and independent refining units into the Permian Basin sector of Southeastern New Mexico and West Texas with a jointly-owned and operated trunk line that would be routed through North Texas producing areas to purchase additional oil is now virtually assured. This project was announced several months ago when Cooperative Refining Associations in Kansas and nearby states proposed to build such a line to fulfill their crude requirements. The carrier would terminate at Valley Center, Kan., requiring about 625 miles of trunk line.

Officials of Consumers Cooperative Association, North Kansas City, Mo., and affiliated units are taking the initiative in carrying out the pipe line project. The independently owned and cooperative refineries in the Middle-West with a combined capacity of 65,000 barrels of crude daily are said to be prospective participants. A spokesman for the cooperative announced that about 50,000 barrels of space has been booked.

The pipe line program calls for the incorporation of a firm to be known as Midway Pipeline Company, with stock interest subscribed by participants on the basis of space to be used in the carrier.

The trunk line will originate near the southeast corner of New Mexico, with an extensive feeder system connecting with fields in Lea, Eddy and Chaves counties, New Mexico. The latter two counties have been subject to pipe line proration for months due to the allowable production exceeding the capacity of local refineries and a single trunk line outlet. An extensive gathering system will be required to obtain crude requirements in West Texas due to the distance between large producing fields. The Slaughter and Levelland fields will likely afford the greatest volume of concentrated crude runs. The South Plains Pipe Line Company, which supplies the Consumers Cooperative Refinery Association's 5000-barrel plant at Levelland, with surplus runs going to the Stanolind Pipe Line Company, is expanding its system in the two fields. The Post area, Garza County, affords a substantial source of 36-38 gravity oil that will be available for the line. Cooperative Refinery Association at McPherson, Kansas, has been the only outlet for this field and nearby pools since last January. Tank car shipments to the Kansas plant are currently averaging 4000 barrels daily.

Preliminary estimates on crude demand and supplies indicate that the group will construct a 12-inch carrier from the Permian Basin to the Wichita Falls sector of North Texas, then increase the size of the line to 14 or 16-inch, depending upon the volume of oil to be available in the lower Mid-Continent district.

An engineering firm has completed a survey of the project, which will cost about $16 million if the present goal of a 85,000-barrel capacity line is constructed to the Valley Center terminal. The majority of the participating refineries could be supplied with crude through existing lines from the latter terminal.

Pipe and pump station equipment for the projected carrier will not be available until late next year and possibly not until 1948 due to manufacturers having been booked to capacity on other lines authorized earlier this year.

Northern Utilities Laying 8-Mile Wyoming Connection

Northern Utilities Company of Casper, Wyo., is laying an 8-mile, 8-inch gas line connecting the Beaver Creek field, Fremont County, Wyoming, with its main line from Sand Draw field into Casper. Beaver Creek has been connected to the same company's line north from Sand Draw to Riverton, Wyo., but the new line will enable the company to use Beaver Creek gas in Casper and points east.

Stanolind Oil & Gas Company is the operator in the Beaver Creek field, and now has three wells completed in the Lower Cretaceous sands at about 8500 feet with open flow of 10 million cubic feet per day each and is drilling two additional wells.

Right-of-Way Work On Mississippi Line Starts

Work on right-of-way has started in connection with the laying of 80 miles of 16-inch natural gas line from Gwinville to Pickens, Miss. Contract for the line was awarded by Southern Natural Gas Company to Latex Construction Company of Houston.

The new facilities will enable Southern Natural to supply gas to a number of communities in Alabama and Georgia.

Gathering Lines to Connect Stanolind Pressure Plant

The Stanolind Oil & Gas Company is laying approximately 80 miles of gathering system in the Hastings field, Brazoria County, Texas, to tie into its new pressure-maintenance plant in the field. The line, consisting of from 2 to 16-inch pipe, is being constructed by Associated Contractors and Engineers of Houston.

Ohio Line Started

Associated Contractors and Engineers, Houston pipe line construction firm, has started laying pipe on Ohio Fuel Gas Company's new 15-mile, 12¾-inch natural gas line in Ohio. The transmission line, costing approximately $266,000, will connect Ohio Fuel's system with that of the Dayton Power and Light Company.

Reconditioning Program Is Announced by Shell

A $1.7 million pipe line reconditioning program in East Texas, West Texas and Oklahoma has been announced by Shell Pipe Line Corporation.

Plans include overhauling 81 miles of the Houston-Kilgore 10-inch line, 19 miles of gathering lines in East Texas and 42 miles of 6 and 10-inch trunk lines in West Texas.

In West Texas, work will be between Denver City and Westbrook and between Haskell and Wichita Falls.

The Oklahoma work calls for the reconditioning of 67 miles of 10-inch between Healdton and Cushing and 38 miles of 6-inch between Arkansas City and Tonkawa.

Contracts have been awarded to Anderson Brothers of Houston and Holland Construction Company of Tulsa.

The work will be completed in about 100 days and will include the uncovering, cleaning, repairing, painting, coating, re-wrapping and recovering.

Texoma and Natural Gas Propose Added Capacity

Authority to enlarge and extend their combined transportation system at an estimated cost of $23,238,613 is sought by Natural Gas Pipe Line Company of America and Texoma Natural Gas Company in a request filed with FPC.

Texoma owns and operates producing facilities in the Panhandle field of Texas and a transportation system extending to Gray, Okla. At Gray, the gas is delivered to Natural Gas Pipe Line's system from which the gas is marketed at wholesale. The facilities requested would increase delivery capacity of the system from 349 million cubic feet daily to 484 million cubic feet daily.

Texoma seeks to add nine 1250-horsepower engines to Station 22 in the Panhandle field and make additions to the dehydration and gasoline plants operated in conjunction with the station and to construct approximately 11 miles of 26-inch line paralleling a section of its present 24-inch carrier.

Natural Gas Pipe Line proposes to add 39 compressor engines of 1250-horsepower capacity to its 9 existing compressor stations; to construct a new 6250-horsepower compressor station and a dehydration plant near Guymon, Okla.; and the construction of about 35 miles of 26-inch loop line, 54 miles of 24-inch loop line, about 31 miles of 26-inch pipe line and about 42 miles of telephone line.

All of the compressor units are planned for installation during 1947 and 1948. The pipe line work is to be started in 1948 and completed during 1949.

Gathering Lines Contract

Humble Oil & Refining Company has awarded contract to Latex Construction Company of Houston for laying 20 miles of 4 to 20-inch gathering lines in the Friendswood (Webster) and Clear Lake fields, Harris County, Texas. The lines will supply Humble's new gasoline plant at Clear Lake with flared gas from the two fields.

Baku Field Scheduled for Big Increase In Production During Next Five Years

Russia's fourth five-year plan contemplates a 50 percent increase in crude oil output from the Baku oil field in the Azerbaijan, Soviet Republic, which is scheduled to reach a production of 17 million tons (123¼ million barrels) annually by 1950, it was said last week.

The drilling program for the Baku fields, which in 1941 produced nearly three-fourths of the total Russian output, calls for 2660 new wells during the five-year period, and prospecting for additional high-yield pools in the Baku, Kirovobad and Kura areas.

Petroleum is the No. 1 resource of Azerbaijan, which also has great iron deposits. In order to insure adequate power for the Baku oil industry, the extensive Mingechaur power and irrigation project will be put under construction, with the first section to be put into operation by 1950. The Mingechaur power plant, when completed, will be second only to the Dnieper station, the largest in Europe, and calls for a 230-foot dam on the Kura River at the village of Mingechaur which will form a lake 31 miles long with 600 billion cubic feet of water.

To keep pace with the development of production, a refining industry was developed and pipe lines, and a machine building industry was established to supply equipment for the oil fields. The current five-year plan calls for the building of Azerbaijan's first pipe-rolling mill.

Two-thirds of the oil produced in the Baku fields is shipped from the port of Baku, where also the refineries and equipment industries are located. The harbor covers 33 square miles and has 14 miles of coast line, and had been equipped and adapted particularly for the handling of oil.

Camacho Regards Mexican Petroleum Outlook Bright

Payment of Mexico's petroleum debt to expropriated American firms, fixed by the Zevada-Cook agreement of April, 1942, will be completed by November 30, 1946, almost a year ahead of schedule, President Manuel Avila Camacho told the 40th Mexican Congress September 1.

The president, whose six-year term ends November 30, said that $1,634,131 remains from the original $5,596,391 debt established by the 1942 agreement. This must be liquidated in two equal payments due September 30, 1946, and September 30, 1947. The former will be paid on the date due and it is anticipated that the latter will be paid before his term expires.

Other remarks by Camacho with reference to petroleum were as follows:

"The level of operations in the petroleum industry rose considerably in 1945.

"Exploration groups were increased and 51 wells were drilled with a potential daily production of 31,000 barrels. Exploration and drilling costs totaled $6 million.

"Two of the completed wells are in La Mision field, Tamaulipas. It is estimated that their yield, along with those already in production, is more than 10 million cubic feet of gas daily.

"The nation's petroleum reserves, conservatively estimated, are 870 million barrels. (The president used this same figure in his report to the congress September 1, 1945.)

"The petroleum industry has covered in the last six years the decisive period in its economic development. Exploration parties between 1941 and the first six months of 1946 selected 77 sites, drilling 24 test wells, among which may be mentioned Mission Nos. 1, 2 and 4; Soledad No. 1, discoveries of an important gas yield at Camargo, Tamaulipas, and others. In general, it may be said that the petroleum industry . . . has progressed and that in the field of exploration the outlook is optimistic."

Shell Parties Exploring Area in State of Guarico

The Shell Group is swinging into the initial stages of exploration to determine potentialities of its large block of acreage in the northwest portion of the State of Guarico, Central Venezuela. With almost all of the companies operating in Venezuela interested to some degree in this vast area, Guarico is one of the most closely watched sectors in the Latin American nation.

Shell's block, still an unknown as to its producing potentialities, comprises some 875,000 acres in exploration concessions from which a selection of no more than 50 percent must be made within the next two years.

In addition to a series of structure holes, the company is operating three reflection seismograph crews, one gravitymeter party, and several geological parties. Operating in this area as Venezuelan Oil and Transport Company, the company is participating in the construction of a new highway from Guanta, near Puerta la Cruz, to El Sombrero. The road will be an important project when completed, since it will give the first all-weather transport road to the likely oil areas of Guarico.

Plans have already been made to start a deep test in the state sometime before the first of 1947, but exact location has not yet been selected.

Plummer in Brazil

F. B. Plummer, geologist of the Department of Economic Geology, University of Texas is now in Brazil, working with geologists at the Brazilian Geological Service in the northwestern part of that country. He will be there for approximately three months.

Tanker Crew Contract Is Signed in Venezuela

Leading oil companies of Venezuela signed a collective contract with their tanker crews, and other oil companies are expected to follow.

While the contract discontinued the war bonus, salary raises were granted amounting to $65 per week. Each sailor was guaranteed 56 hours work a week, overtime for night work, and longer vacation periods with pay.

Dr. Carlos Lander Marquez, who represented the oil companies in the negotiations, said it was the first time a collective contract had been signed between oil companies and oil workers unions without official intervention.

Uniform Oil Law

Efforts are being made between the governments of Venezuela and Colombia to have uniform customs and oil legislation, a step which is expected to bring closer bonds of friendship and commerce between the neighbors. A committee to study the oil situation in the two countries has been selected by the Venezuelan government as follows: Dr. Carlos Perez de la Cova, Dr. Ramon Carmona, and Dr. Jose Martorano. The Colombian committee is expected to be named shortly.

Creole Production

Creole Petroleum Corporation's oil production in Venezuela continued upward during July, averaging 580,053 barrels daily, compared with 570,000 barrels daily in June, and 504,163 barrels in July, 1945. Production in the Lake Maracaibo area and Cumarebo was 425,974 barrels daily in July, compared with 420,152 barrels in June and 340,393 barrels daily in July, 1945. July output in Eastern Venezuela was 154,079 barrels daily against 149,888 barrels in June and 163,770 barrels daily in July, 1945.

Lavadenz Relieved Of YPFB Presidency

Alberto Creso, former Bolivian Minister of Economy and President of Bolivian Development Company, is credited with having been offered the presidency of Yacimientos Petroliferos Fiscales Bolivianos, government-owned oil industry, to succeed Jorge T. Lavadenz.

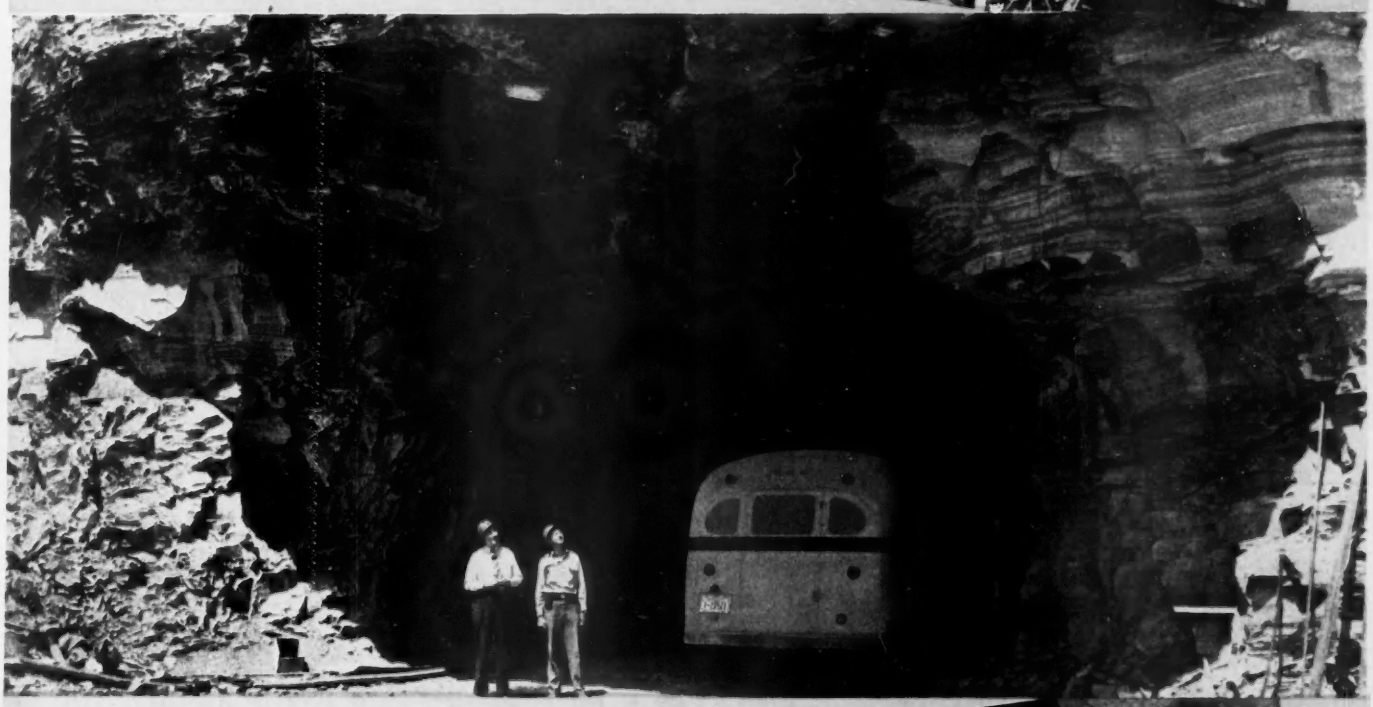
Further reports indicate that Creso will refuse the office although the Bolivian Ministry of Economy, which appoints the YPFB head, is hopeful that he will reconsider and take the post.

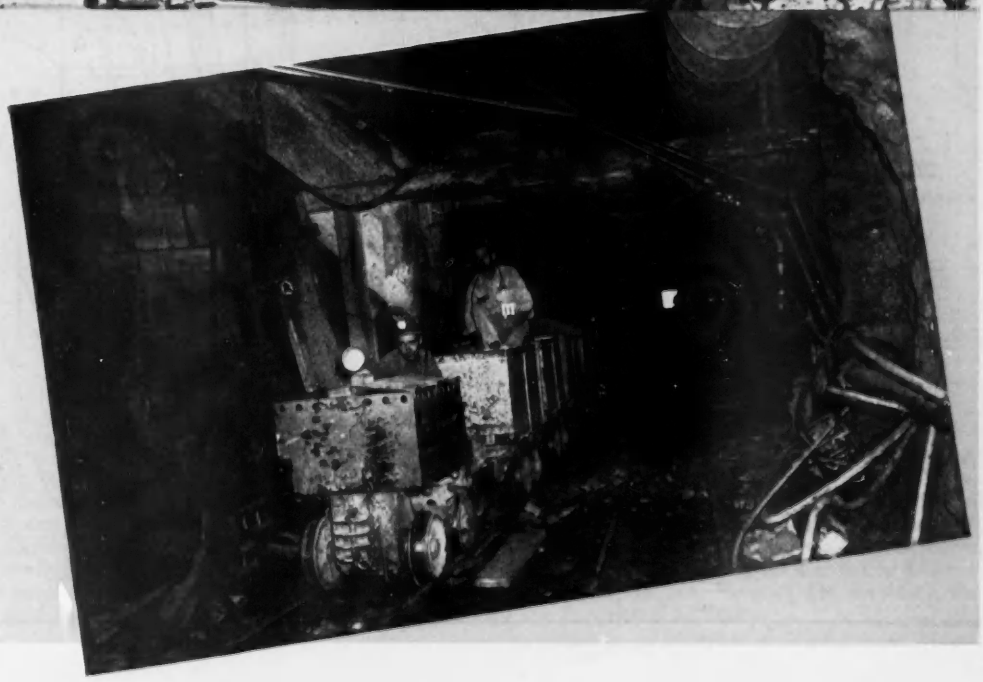
Lavadenz was relieved of the presidency while in New York on a recent visit. The shakeup in YPFB followed the recent political change in Bolivia but the YPFB plan of seeking United States capital for intensive oil development is believed to have been left unchanged.

Bolivia's oil program now is reported to be under the direction of Guillermo Mariaca, YPFB general manager.

Shale Oil EXPERIMENT

Two thousand feet above the Colorado River, near Rifle, Colo., the United States Bureau of Mines is starting experimental work in a project to develop the nation's shale oil resources. The bureau estimates that the western mountains hold some 100 billion barrels of oil, five times more than produced by the petroleum industry since drilling started in 1859. The mining experiment, findings of which will be passed on to private industry, is designed to prepare to use shale oil in case of need—as, for instance, in war. Experiments will be made in the extraction of the oil by "retorting." To accommodate the workmen on the $1½ million demonstration plant, the government has built 30 houses at Rifle and another 20 houses will be added later.





Top picture: A crew drilling holes in the oil shale deposits in the mine high above Rifle to test the richness of the ore.

Center: Entrance to one of the mine shafts. Aerial tramway will carry the shale to the plant at Rifle where the oil will be extracted by "retorting," in which the shale is crushed and heat is applied to separate the oil in vapor form.

Lower: The oil shale is shown being brought out of the mine by railroad cars. Ways of getting rid of the vast amounts of spent shale present one of the major problems the Bureau will attempt to solve.

Wide World Photos.

Missouri

ITS OIL and GAS POSSIBILITIES

By FRANK C. GREENE
Geologist, Missouri Geological Survey

AT THE end of 1945 there were 43 active oil wells in Missouri and production for the year was 37,714.6 barrels, an average of about 104 barrels per day. There were 36 gas wells which produced 77,575,955 cubic feet.

Oil has been produced commercially in Vernon, Cass, Jackson, Clay, Platte and Atchison counties. Gas has been found in Vernon, Bates, Cass, Johnson, Jackson, Clay, Ray, Platte, Caldwell and Clinton counties. This establishes most of the western counties of the State as potential area.

Until the Forest City Basin leasing and drilling campaign, oil and gas production in Western Missouri, along with that of the shallow fields of Eastern Kansas, was confined to Pennsylvanian beds ranging in depth from 200 to 700 feet. The McLouth field in Leavenworth and Jefferson counties, Eastern Kansas, obtained oil in the Mississippian; the Falls City and associated pools in Southeastern Nebraska found the Hunton (Devonian) productive; and in the Tarkio pool in Atchison County, Missouri, oil was found in a sand at or near the Bartlesville horizon. These discoveries have opened new horizons previously unknown in Northwest Missouri and have greatly stimulated wildcatting.

In considering the future of the industry in Missouri, the subject can be handled best by dividing the state into a southern area extending from Platte County to Vernon County, and a northern area which includes the northwestern counties of Missouri.

Southern Area

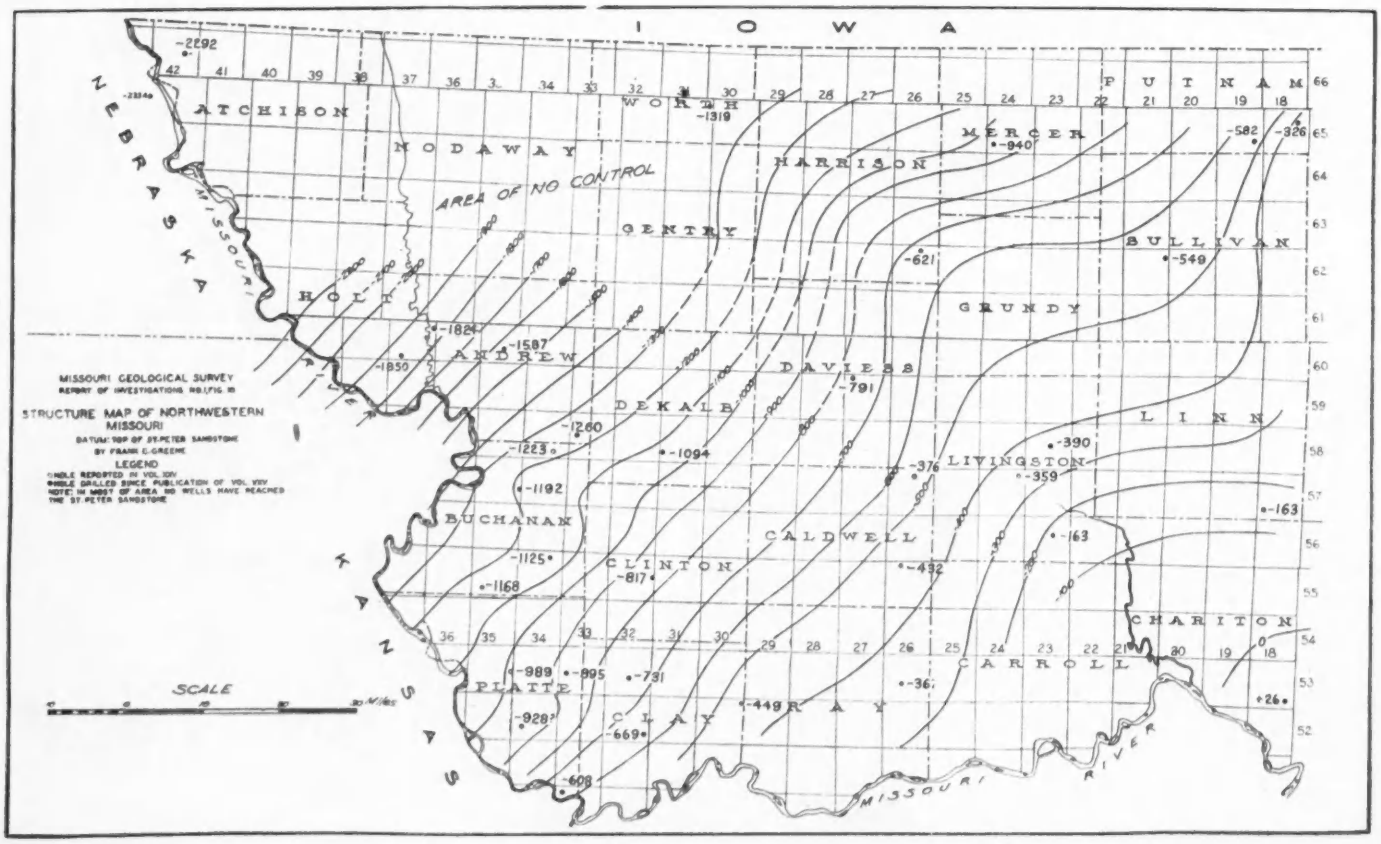
The southern area, in common with that in Kansas, extending from Kansas

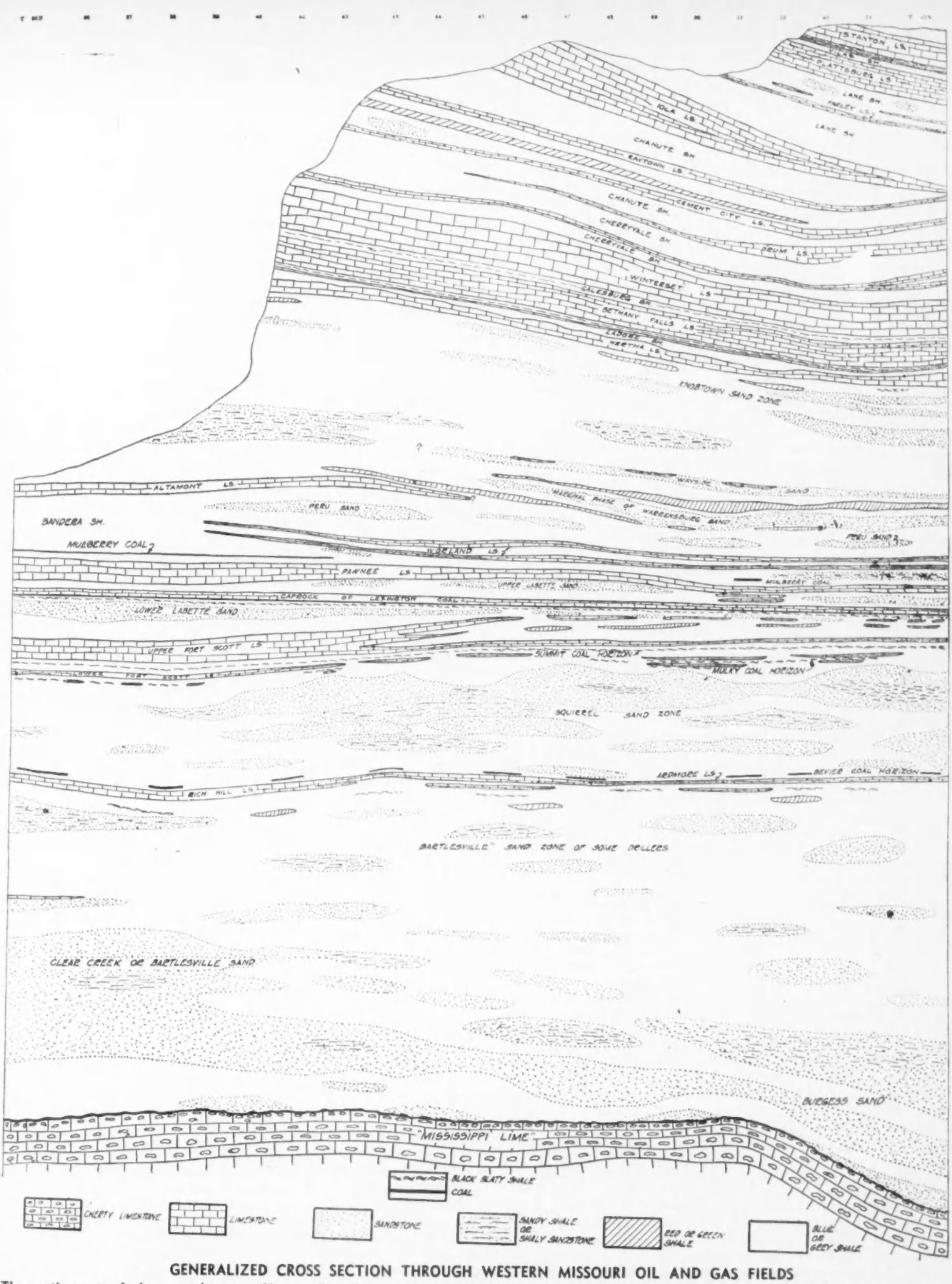
Published by permission of Dr. Edward L. Clark, state geologist, Rolla, Mo.

Accompanying this article and to be studied in connection therewith is the full page "Generalized Cross Section Through Western Missouri Oil and Gas Fields" which appears on page 35.

The article is concluded on page 36.

Structure Map of Northwestern Missouri

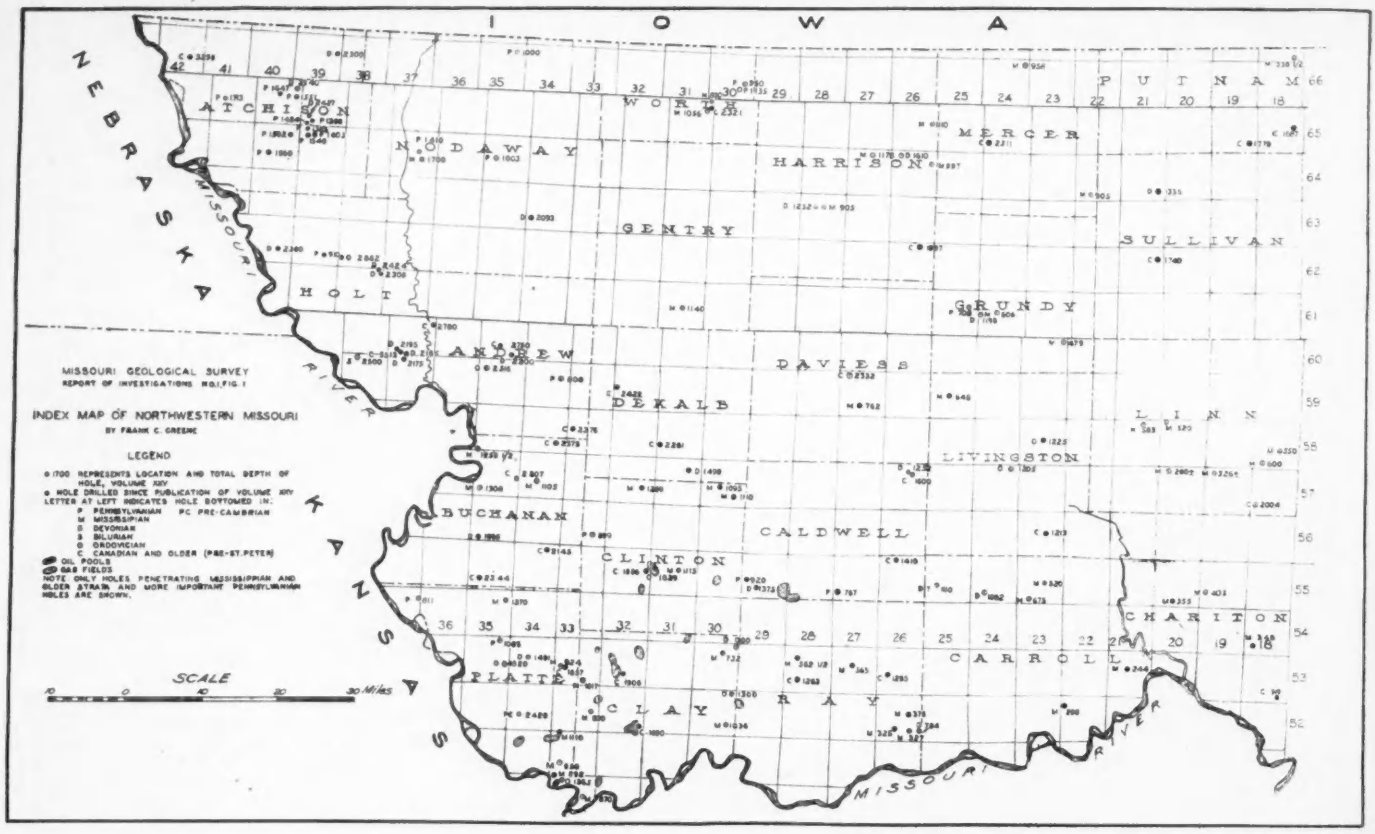




GENERALIZED CROSS SECTION THROUGH WESTERN MISSOURI OIL AND GAS FIELDS

The section extends from southwestern Vernon County to southern Clinton County through the middle of the productive area of western Missouri. It is based on well logs lined up on the cap rock of the Lexington coal horizon in the Labette shale, and is drawn to show the position of the producing horizons. The section does not show structural features. The horizontal scale is 1 to 500,000 (approximately 8 miles to an inch) and the vertical scale is 50 feet to an inch. Gas occurs in the top of the Winterset limestone, the Galesburg shale, the Ladore shale, the Knobtown sand, the Wayside sand, the Warrensburg (?) Channel sand, the Peru sand, Upper and Lower Labette sands, in the black shales at the Lexington, Upper Fort Scott (Summit) and Lower Fort Scott (Mulky) coal horizons, the Squirrel sand zone, the black shale above and below the Rich Hill or Ardmore limestone and in several black shales and sands in the lower part of the Cherokee formation. Oil occurs in the Wayside sand (as showings), the Warrensburg (?) Channel sand, Squirrel sand zone, and the Bartlesville sand. The Burgess sand has showings of oil.

Index Map of Northwestern Missouri



City to Fort Scott, has been producing oil and gas for many years from shallow Pennsylvanian sands. The wells are small, one to ten barrels being average for oil and 5 million cubic feet the largest initial open flow of gas which is authentic. The largest oil well made 73 for a few days. Throughout the area, both in Kansas and Missouri, many deep tests have been made. Some were drilled in the midst of Pennsylvanian production, some on structures and others on "doodle-bug" locations. In several cases they have been carried to the pre-Cambrian, but to date there has been no production of oil or gas below the Pennsylvanian.

Mississippian a Possibility

Asphaltic residues have been found in the Mississippian in several places in the area, and Mississippian production is a possibility, but the gravity of the oil probably will be very low. The possibility of production below the Mississippian is remote.

For the operator who can drill and produce cheaply, the shallow Pennsylvanian sands offer an opportunity. Outcrops are plentiful and accurate structural contours can be obtained by plane table mapping. There are also pools of the lense and shoe-string type which exist without regard to structure.

In the northwestern counties there are potential producing horizons in the Pennsylvanian, Mississippian and Devonian (Hunton), with lower zones an unknown factor. Along with the deeper drilling there are two obstacles. Much of the area is deeply buried beneath glacial deposits, effectually concealing the Pennsylvanian outcrops.

It is generally recognized that Mississippian and older production, wherever found in the Mid-Continent region from Falls City, Neb., south through Kansas and Oklahoma, is in an area of local pre-Pennsylvanian uplift and erosion. There is good reason to assume that the same condition prevails in Missouri. The unconformity between the Pennsylvanian and Mississippian does much to conceal the structure of the Mississippian (and older) beds.

Until some geophysical method of locating these buried uplifts is perfected, surface mapping, supplemented by core drilling, must be used. If Pennsylvanian beds reveal a closed structure, it should be tested deep enough to determine whether the Mississippian has undergone pre-Pennsylvanian erosion. If late Mississippian beds are present, there is a very slight chance of obtaining production in the Mississippian or older beds, but if the test shows truncation of the Mississippian, it is advisable to carry the hole deeper.

With the double screen of glacial drift and Pennsylvanian-Mississippian unconformity, wildcatting in Northwestern Missouri calls for well-planned mapping and core drilling campaigns, such as opened the Tarkio pool. It is reasonable to assume that other pools of the same type remain to be found when it is recalled that in much of the area of eastern Kansas and Oklahoma, groups of pools in a given sand are common.

Other Active Areas

Three other areas of Missouri have been the scene of wildcatting. Many holes have been drilled in the Ozark area, some at great cost into pre-Cambrian granite. The rock formations of the Ozark region have such an abundant supply of fresh water that most of the larger cities used deep wells for a water supply. To the legitimate operator that should be the answer, but promoters probably will continue to wildcat there.

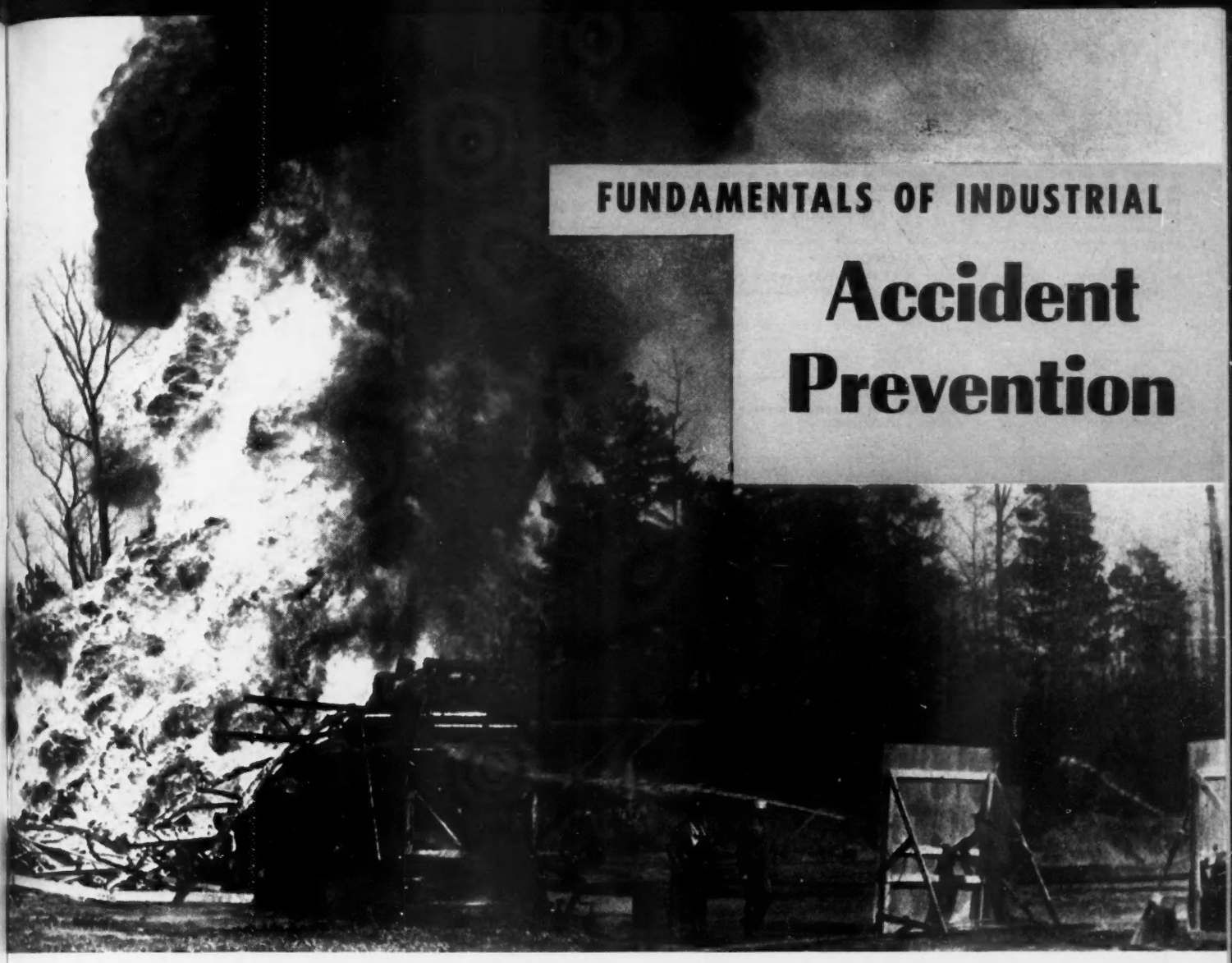
The Lincoln fold region of Northeastern Missouri is still a potential area, but has the disadvantage of a heavy cover of glacial drift, making difficult geological and structural observations.

Geophysical Work Needed

The lowland belt of Southeastern Missouri properly belongs in the Gulf Coastal province. The only feasible method of exploration is geophysical, and drilling should not be attempted until the latest approved methods of exploration have proven the existence of subsurface conditions that warrant the heavy outlay that a thorough test in that region will cost. In this area the unconsolidated sands of the Cretaceous truncate the Ordovician and Cambrian dolomites. These dolomites are very similar in their physical characteristics and as a consequence seismic prospecting may not reveal buried structures. Magnetic and gravity surveys have possibilities and geochemical methods might also yield valuable information.

Stanolind to Move Office

The Stanolind Oil Purchasing Company will move its offices from Tulsa to Cushing, Okla., due to cramped housing, R. T. Thompson is general superintendent of the division.



FUNDAMENTALS OF INDUSTRIAL

Accident Prevention

A special fire-fighting crew works behind barricades in preparation for placing a dynamite shot to shoot out a gas well fire. The fire occurred as final gauges were being taken. When gas from a needle valve, which had been closed off due to ice forming in the nipple, became unthawed, condensate shot through the opening, hitting the ramp of the derrick and glancing off toward the boilers. The mixture flashed from the fire in the boilers which were still in service.

Part 6 Investigation of Accidents

By C. L. HIGHTOWER, Safety Director,
United Gas Pipe Line Company and Union Producing Company

THE report form completed by the injured worker usually gives only a limited amount of information on the cause of the accident and the measures which can be taken to prevent a recurrence. In order to supplement this information, some companies require an investigation report from the foreman under whose supervision the injured employe works. The type of information requested and the manner in which the reports are handled vary with each company, but in all cases the basic idea is to get the foreman to make a personal investigation of the facts surrounding the accident, determine the cause and take whatever action is necessary to correct the situation responsible.

The following statements are required of the foreman on the "Supervisor's Report on Investigation of Accident" which is on the reverse side of the employe injury report used by one company. (See Figure 1.)

1. I have made a personal investigation of the accident which resulted in the injury to the above employe, and following is my report as to the cause:
2. I have issued the following instructions as to correct manner of doing this work with a view of preventing recurrence:
3. The following repairs or replacements have been made to tools, machinery, or other equipment looking to the removal of the hazard responsible for this accident:

It will be noted that Item 2 is worded to bring out information as to the unsafe practice involved, while Item 3 deals with the physical hazard responsible. In both instances the foreman is requested to state what specific action he has taken to remedy the offending cause.

When completed, this report is signed by the foreman and forwarded to his department head or manager for approval. In this way the line executive is kept informed as to the accidents that are occurring and what is being done about them. When the foreman gives "carelessness" as the cause, or states that his instructions consisted of telling the worker to "be more careful in the future," the report is referred back for more detailed and specific information.

Another company has an accident cause analysis printed on the reverse side of the employe injury report and requires the foreman to check off the primary cause. From the typical cause analysis shown as Figure 2, it will be noted that one list of causes is given under the heading of "supervisory" and another group under "physical." The foreman is asked to check only one cause under each heading.

Under the committee plan of safety organization, investigations are sometimes made by an accident investigation committee. The functions of such committees and the investigation procedure normally followed are covered under the preceding section on safety committees.

Investigations are also made by the safety engineer. This is particularly true in lost time, unusual, or serious accident cases. This investigation is usually in

Figure 1

SUPERVISOR'S REPORT ON INVESTIGATION OF ACCIDENT

In order that we may have a more detailed report as to the cause of the accident in which this employe was involved and also that we may be informed as to the action taken to prevent a recurrence of similar accidents in the future, we ask that the foreman under whom the injured was working at the time of the accident complete the following form. After the foreman has completed and signed the report, it is to be passed to the District Manager for his approval before mailing.

FOREMAN'S REPORT

1. I have made a personal investigation of the accident which resulted in the injury to the above employe, and following is my report as to the cause:

_____

_____

_____

2. I have issued the following instructions as to correct manner of doing this work, with the view of preventing a recurrence:

_____

_____

_____

3. The following repairs or replacements have been made to tools, machinery or other equipment looking to the removal of the hazard responsible for this accident:

_____

_____

APPROVED_____
District Manager

SIGNED_____
Foreman

Figure 2

ACCIDENT CAUSE ANALYSIS
Basic Accident Causes
(Only 2% are unpreventable)

SUPERVISORY
(88% of all Accidents have Supervisory causes)

1. FAULTY INSTRUCTION
   (a) None
   (b) Not Enforced
   (c) Incomplete
   (d) Erroneous
2. INABILITY OF EMPLOYE
   (a) Inexperience
   (b) Unskilled
   (c) Ignorant
   (d) Poor judgment
3. POOR DISCIPLINE
   (a) Disobedience of rules
   (b) Interference by others
   (c) Fooling
4. LACK OF CONCENTRATION
   (a) Attention distracted
   (b) Inattention
5. UNSAFE PRACTICE
   (a) Chance taking
   (b) Short cuts
   (c) Haste
6. MENTALLY UNFIT
   (a) Sluggish or fatigued
   (b) Violent temper
   (c) Excitability
7. PHYSICALLY UNFIT
   (a) Defective
   (b) Fatigued
   (c) Weak

PHYSICAL
(10% of all Accidents have Physical causes)

1. PHYSICAL HAZARDS
   (Include mechanical, electrical, steam, chemical conditions, etc.)
   (a) Ineffectively guarded
   (b) Unguarded
2. POOR HOUSEKEEPING
   (a) Improperly piled or stored material
   (b) Congestion
3. DEFECTIVE EQUIPMENT
   (a) Miscellaneous materials and equipment
   (b) Tools
   (c) Machines
4. UNSAFE BUILDING CONDITIONS
   (a) Fire protection
   (b) Exits
   (c) Floors
   (d) Openings
   (e) Miscellaneous
5. IMPROPER WORKING CONDITIONS
   (a) Ventilation
   (b) Sanitation
   (c) Light
6. IMPROPER PLANNING
   (a) Layout of operations
   (b) Layout of machinery
   (c) Unsafe processes
7. IMPROPER DRESS OR APPAREL
   (a) No goggles, gloves, masks, etc.
   (b) Unsuitable—long sleeves, high heels, defective, etc.

Foreman's check list used by one company. Foreman is requested to check one cause only under each heading.

addition to that made by the foreman in charge.

Where practicable, the safety engineer makes his investigation at the same time the foreman investigates the accident, and prepares his report. Where this is not possible, the engineer checks with the foreman first and gets his ideas on how and why the accident occurred and then requests the foreman to go with him to the scene of the accident to assist in interviewing the injured employe or witnesses who may have some knowledge of what happened. In this way the safety engineer not only makes use of the foreman's experience and training in arriving at the cause, but because he is open and above-board in his methods, he retains the friendship and confidence of the foreman.

After his investigation is complete, the safety engineer discusses his findings with the foreman and gives the foreman his recommendations as to how to correct the conditions or practices responsible. If there is a difference of opinion as to the cause of the accident, and the corrective measures that should be taken, the foreman and safety engineer take their problems to the department head or manager and try to work out a solution. Sometimes the foreman is convinced that he is in the wrong and is sold on the safety engineer's suggested procedure. On the other hand, the safety engineer may be convinced that he is in the wrong and will withdraw or change his recommendations. In any event, it is usually possible for the men to come to some agreement as to what happened and what should be done about it.

The safety engineer codes the information developed by his investigation as to the type of injury, unsafe work practice, unsafe work condition, agency, direct cause, and basic cause, and reports the results to the safety department on an "Investigator's Report on Personal Injury" form. From this report the safety department prepares a tabulating form and sends it to the tabulating department so punch cards can be made and filed for future use in tabulating various types of information required on when, where, how and why accidents occurred on any operations for any given period.

Figures 3 and 4 show a sample copy of the investigator's report form used by the safety engineer.

The following classification on basic causes of accidents was developed from punch cards tabulated from information developed on the Safety Engineer's Investigation Reports.

Basic Cause	No. of Accidents
DISCIPLINE	
Horseplay	1
EQUIPMENT AND PROPERTY	
Improper Installation	1
Improper or Inadequate Material Used	2
Poor Housekeeping	5
Lack of Inspection and Maintenance	11
Suitable Tools and Equipment not Provided	5
Suitable Protective Equipment not Provided	12
INSTRUCTIONS	
None Given	35
Incomplete	3
Not Understood	1
Not Enforced	36
ORGANIZATION	
Insufficient Help	3
Workmen not Qualified	6
Job not Planned	13
Job Improperly Planned	8
Lack of Foremanship Training	2
Lack of Supervision	11
NOT OTHERWISE CLASSIFIELD	49

INVESTIGATOR'S REPORT ON PERSONAL INJURY

Dated ..... By .....

Case No. ..... No. Prev. Accid. ..... Comp. No. .....

Name ..... Company ..... State ..... District .....

Department ..... Location ..... Date ..... Day ..... Time of Day .....

Age ..... Service Since / Date of Last Employment ..... Cumulative ..... Occupation .....

Foreman ..... Physician ..... M. D. Witnesses .....

Cause of Accident:

Foreman's Instructions on Accident:

Figure 3

CLASSIFICATION OF ACCIDENT

TYPE OF INJURY: Code No. ..... Type ..... Part of Body: Code No. ..... Part .....

OPERATION: Code No. ..... Name .....

Sub. No. ..... Name .....

UNSAFE WORK PRACTICE: ..... No. ..... Page: .....

UNSAFE WORK CONDITION: .....

Engineering: ..... Maint. Tools or Eqpt .....

Misc. .....

AGENCY: Code No. ..... Name .....

Sub. No. ..... Name .....

DIRECT CAUSE: Code No. ..... Cause .....

Sub. No. ..... Cause .....

Remarks: .....

BASIC CAUSE: Code No. ..... Cause .....

Sub. No. ..... Cause .....

Remarks: .....

SEVERITY: Code No. ..... Extent .....

ESTIMATED CLAIM EXPENSE (OPEN)				ACTUAL CLAIM EXPENSE (CLOSED)			
DAYS LOST	MEDICAL	COMP.	TOTAL	DAYS LOST	MEDICAL	COMP.	TOTAL

Figure 4

Geology

By
PROFESSOR VINCENT C. ILLING
Professor of Geology, Imperial College of Mines & Technology, London, England

APPLIED TO PETROLEUM

Part 4

Oil Recovery and Exploration

IN A PREVIOUS section it was noted that in the earlier days of the oil industry the methods of oil discovery were essentially unscientific and involved a considerable wasted effort. This, however, was largely the result of the fact that in the U. S. the areas which were first developed did not lend themselves to detailed structural analysis because of the lack of structure. Both in the Appalachian Pools and Lima, Ind., the rocks were practically horizontal.

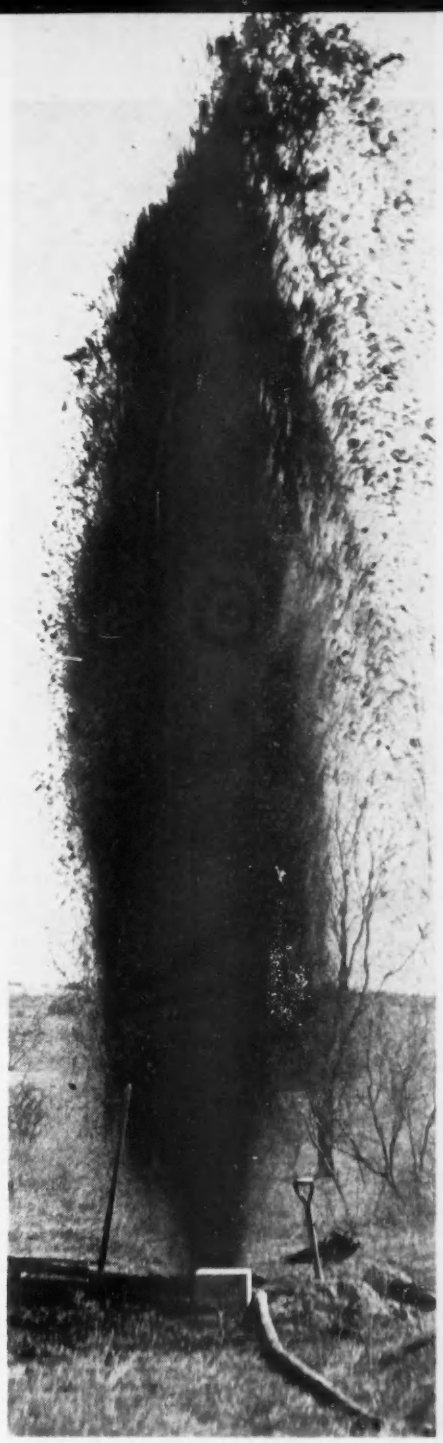
However, in the fold fields of the European oil areas and also in those of the U. S. which were discovered after the beginning of the present century, the role of the geologist became more and more important. This also was due to the increased depth of drilling, which made failure more costly and the tendency of the oil industry to become organized into large operating companies with well-developed scientific staffs. There was a great increase in the development of geological studies of oil pools after 1910, and within less than a decade there were more geologists used in oil prospecting than in any other operations. As each region came into the picture its local geological characteristics were studied and the method of attack was suited to its peculiarities. In the folded oil fields of the world the anticlinal theory dominated all else. Normal methods of geological field studies were carried out, and the basis of the drilling was initially the structural interpretations produced by field mapping.

However, as time progressed and drilling became deeper and deeper, structural problems of great difficulty arose, partly due to the changes in the deformation of the rock with depth and also through the difficulties of controlling drilling at such great depths. Oil geologists became involved in studies of the obliquity of boreholes and of the interpretation of the cores which were obtained under such conditions. Subsurface studies became more and more involved until they often claimed an attention greater than that of surface mapping.

In other areas, such as the broad monocline of Kansas and Oklahoma, where the dominant structure was a uniform gentle dip, normal field methods with clinometer and compass were of little value. The structures were so gentle that only careful levelling of formations with a theodolite or level could portray them accurately, and the geological staffs used in such exploratory work were largely concerned in plane table mapping and levelling. Later on, when the results of surface studies had been exhausted, geophysical methods were introduced. To these particular structures the reflection method of seismic survey was especially adapted, and in the course of time most of these areas were re-surveyed by geophysics in order to identify sub-surface structures which could not be detected at the surface and to delineate the changes in the structures downwards. Where conditions are favorable such reflection methods can be successfully employed to depths of over 10,000 feet, but it should be noted that in adopting such methods of attack, geophysics is not being used as a direct method of identifying oil, but as a means of delineating geological structure. Had this been fully appreciated it is probable that a considerable improvement would have been achieved in the application of geophysics. It was only in recent years that the essential measure of cooperation between geologists and geophysicists has been properly realized.

Throughout the history of oil discovery a considerable measure of use has been made of surface oil indications. In the early days they were regarded with much greater confidence than they are now, largely perhaps because it was not fully realized that an oil or gas seepage is only the beginning of a long line of investigation. Its occurrence does not necessarily give any indication whether reservoir has just been perforated and has lost only a fraction of its contents or whether it is in the last stages of decay. Thus the interpretation of surface indications becomes a study which can only be properly completed after the area has been mapped and the relationship of the surface shows to the stratigraphy and the structure have been worked out. In spite of this, considerable successes have been achieved purely by following surface indications, but they are balanced by a large number of failures where the significance of the surface shows was not properly appreciated.

The methods of oil discovery are tending more and more to be controlled on a proper scientific basis and in this work the geologist takes his rightful place as the proper person to control the campaign. It is now realized that petroleum is not a rare substance, but is formed quite commonly in areas of marine sedimentation, and the first process of attack therefore is a stratigraphic study wherein the sedimentary history of an area is carefully considered. In this work the rock types and the thickness and regional distribution of source rocks is one of the primary studies. Secondly, and of equal importance, the distribution of possible reservoir rocks and their relationship to the source rocks must be a parallel study. It is here that the surface or sub-surface indications of oil are taken into account. The third stage in the study becomes a structural one. In this suitable trap structures are carefully mapped, using all methods of surface mapping and sub-surface investigations available to the geologist. It is here that geophysical methods of attack find their true scope. The final results of these structural inquiries are then considered



"The shot." Geophysical crews explore the earth to map out likely oil-bearing structures.
(Photo courtesy Cities Service Oil Company)

Acknowledgement: Professor Illing's paper: "Geology Applied to Petroleum" is published by THE OIL WEEKLY in accordance with arrangement and consent of members of the Council of The Geologists Association, London, England, for the purpose of acquainting Americans in the oil industry with the work of scientists abroad.

Geologist identifying fossils in core samples from well to determine the age of the rock.
(Photo Courtesy Standard Oil Company, N. J.)

by the geologist in relationship to the source and reservoir rocks below.

Oil Dispersal

In this final study the question of oil dispersal becomes one of great importance, for the oil geologist is not concerned with the mere discovery of petroleum, but with an assessment of the possibilities of oil in considerable bulk. He must therefore take into consideration the quantity of oil which drilling is likely to discover and the costs not only of the exploratory campaign, but of the winning of the oil when it is found. This is perhaps the most difficult of all his problems, as it involves not only an accurate knowledge of the structures and lithology, but a proper assessment of the geological history of the area and in particular of those conditions which may have dispersed the oil and gas at some previous phase.

The fact that drilling has been gradually extending deeper and deeper into the sedimentary basins, and nowadays the geologist is often concerned with problems of structure which may be 5000 or 10,000 feet in depth, or deeper, must be taken into account in assessing the success of geology in oil discovery.

The achievements of the engineer in oil well drilling have been phenomenal. He has doubled and trebled within the last two decades the depth of economic drilling, making it possible to drill wells of over 5000 feet in less than a fortnight, and wells of two miles in less than three months. To appreciate what this means one must know something of the difficulties of the task, but when we add to this the fact that in spite of increased costs of material and of labor the drilling costs per foot have been going steadily downwards, the achievements are still more remarkable. The engineer, however, cannot work miracles, and in spite of his efforts the great increase in the depth of drilling has necessarily meant an increase in the costs of exploratory wells. The oil industry is severely competitive, and the only way in which it has been able to face these increased costs is by careful control of the risks. In spite of the exhaustion of the shallow and more obvious areas, the rate of oil discovery has not diminished; in fact, the percentage of failures has tended to be lower than in early days. One would have anticipated that with the exhaustion of the more obvious fields the percentage of failures in exploratory drilling would have tended to rise. Presumably it must do so at some later phase in the industry, but we can justly claim that the fact that this has not taken place up to the present is primarily due to the efficiency of the oil geologist in the campaign of discovery and to the degree of cooperation now attained between the geologist, geophysicist and the engineer in carrying out the attack.

Oil Recovery

The popular conception that the function of an oil geologist is the discovery of oil is a very inadequate picture of what our science is doing in the oil industry. It may have been true of the position in the early part of the present century, when the work of exploitation, that is, the control of the drilling program, was left in the hands of young and inexperienced geologists on the assumption that little knowledge was necessary to carry out this work. Gradually, however, a few more far-seeing geologists began to realize that there was more in the function of exploitation geology than the mere program of drilling. Geologists and engineers became aware of the enormous waste which took place underground, resulting in the recovery of only a small fraction of the total oil reserves. In this field the achievement of oil exploitation compared very unfavorably with mining practice, and it began to be realized that where the efficiency of recovery was seldom as good as 25 percent of the available oil, there was a big field for scientific research and subsequent action to effect an improvement. The old wasteful methods of production were replaced by a more coordinated scheme in which the final arbiter of success was the percentage recovery of oil. The result has been a revolution in production methods and at the same time it has helped to introduce a great change in the petroleum industry itself. This has gone far to remove many of the evils of unbalanced production, which have made oil a byword for fluctuations between slump and boom. The new era is one of controlled recovery.

Added to this consciousness of a need for more scientific control of production there arose at the same time a series of stringent demands on geological departments for greater efficiency. Drilling was becoming deeper, drilling methods were altering and becoming faster, requiring more careful planning and greater control. The geologist was required to make forecasts to greater depths and could only do this by building up his organization to obtain the fuller evidence required. This needed wider regional studies of the geology, more detailed paleontological and petrographic studies, and careful measurements of stratigraphy. The oil geologist's problem is always that of the rocks below ground. Those at the surface are merely used as evidence for the buried data. New and more detailed studies of earth structure, of their variation with increased depth and changes in lithology and the science of geological exploitation, become more and more associated with carefully measured geology on the one side and its impact on petroleum engineering on the other. New methods of attack were evolved, the chemistry of the water in sands, the doctoring of muds for drilling, the study of the verticality of boreholes and the utilization of borehole data. Finally, new possibilities of geophysical attack, particularly the application of the electrical survey, became exceedingly valuable methods of identifying the main basis of local rock correlation. Viewed as a whole the effect of these methods was always towards a more detailed knowledge of structure and lithology leading to a more complete study of the characteristics of the reservoir.

Within the reservoir itself the interplay of gas, oil and water became the basis of purely physical studies in which, however, the geologist was directly concerned, because the physical forces involved were the results of processes within the sediments which could only be studied with a geological background. Here we see a new field of scientific endeavor wherein the geologist engineer, chemist and physicist

were required to collaborate in order to achieve success. In these general studies geology acted as the main basis of inquiry. It alone, by a study of the reservoir and of the working of nature's forces, could depict the limiting conditions which prevailed underground. The exploitation of an oil pool is nothing more or less than an artificial rejuvenation of the migration process similar to that which nature interposes when deep-seated weathering produces an oil seepage. However, in oil exploitation man controls the rate of oil dispersal for his own benefit.

Viewed in this light geological exploration and exploitation supplement each other. The first is bent on discovery of an oil pool which is merely a temporarily arrested phase of oil migration; the second studies how this pool can be attacked in such a way that the forces of migration are set in motion again and will bring the oil to the surface with the minimum loss.

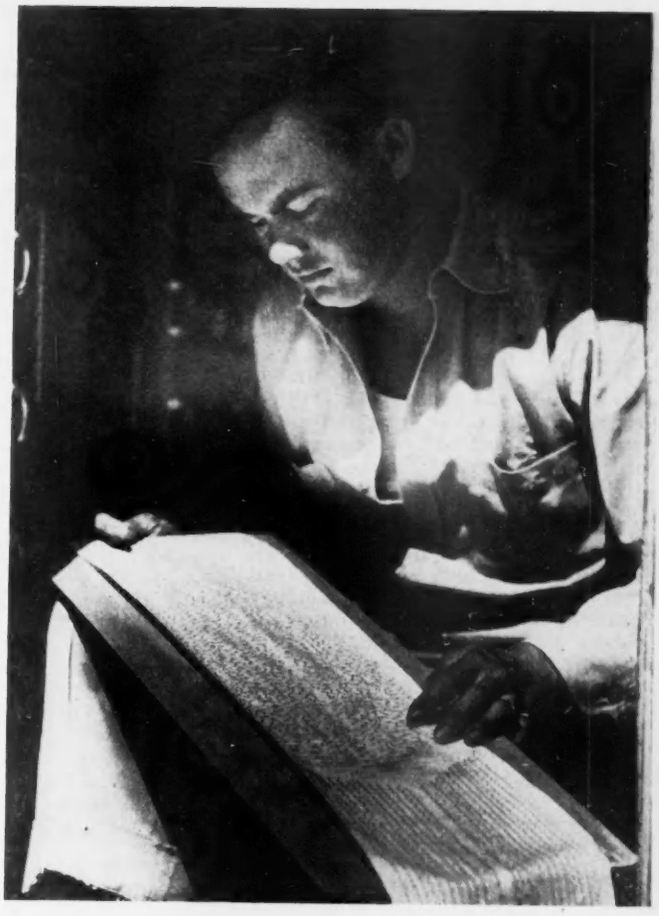
Exploitation Principles

The essentials of an oil reservoir are simple, a zone of porosity surrounded by one of impermeability. The porosity can be and usually is the inter-granular space of an uncemented or partially cemented sediment, such as grit, sand, limestone or dolomite. It may, however, have porosity of a quite different nature, the fissuring of a compact rock by joints, bedding planes and minute fractures. In some rare instances the cavities may even be large, being produced by solution or by large fracture fissures. Each and all of these features can contribute to the condition of porosity, but there is one overriding factor which must be common to all; the pores must lie in intercommunication, that is, the rock must be permeable.

It is only this latter feature which allows free movement within the rock mass and furthermore it is only by an adequate amount of porosity and permeability that it can give up its oil with sufficient rapidity to make a commercial oil well. There are undoubtedly many large accumulations of oil which remain locked in the earth and are useless because their form of entombment does not allow them to be rapidly recovered. There are also, it may be added, many reservoirs of oil and gas which hardly pay for recovery because their thickness, depth, or rock texture militates against an economic recovery.

A careful study of the world's oil pools will show that the industry has only succeeded in its rapid progress by reaching a high stage of efficiency; that is, by the way it is able to deal successfully with these borderline cases.

A reservoir of oil and gas is normally sealed both above and below by impermeable rock. The impermeability may be due to the lack of pore space or it may on the other hand be due to water saturation under pressure. Most oil fields are underlain by what we called edgewaters. This physical conception of the essentials of a pool is but one side of the picture. The whole of the liquid and gaseous contents is under pressure which has been due to earth forces during and after the oil was trapped. Normally these forces are in balanced equilibrium. The gas represents the excess gas which is not dissolved in the oil. The water is normally the buried connate water which was entombed in the original sediments, or it may be meteoric water under external pressure.



Observer inspecting shooting record in connection with geophysical exploration work.

(Photo courtesy Cities Service Oil Company)

Use of Pressure

Instead of concentrating attention on the gas and oil we merely regard the whole set of reservoir conditions as that of fossilized latent energy, partly chemical and partly physical. In doing so we come to the realization that the latter energy is our principal ally in oil recovery. One of the first essentials therefore in oil exploitation is to distinguish whether the pressure is concentrated in the gas or whether the waters which underlie the oil and gas are a separate source of pressure by virtue of their contact with outside influences. In the first case the exploitation geologist must conserve his gas pressure to the very last and use it with maximum efficiency for oil recovery. In the second case the gas pressure may be regarded as merely a reflection of the water pressure and the pool recovered largely by water drive. Thus, at the very outset of an exploitation program the controlling source of the reservoir pressure determines the method of oil extraction, and controls the basic program of drilling.

At the same time, the conditions of reservoir porosity and permeability play so important a part in the movements of oil recovery that they must also be taken severely into account in the scheme of wells. The oil reservoir is in no way like an underground tank filled with oil and gas. It is rather like a sponge saturated with these materials and like all sponges it may vary in its texture. If it were saturated with one liquid alone these variations in texture might not be of first importance, as they would only determine the rate of flow. Where, however, as in an oil reservoir, there are usually three fluid media, water, oil and gas, each with its own surface tension and mobility, the flow of such mixtures in capillary zones is a very complex phenomenon. It is quite possible for all three liquids to move, for two of them, or for one alone, nor need they move with the same velocity or along the same channels. This produces a differentiation within the reservoir and selective movement of the different materials to the well. A study of these movements is exceedingly complex and we are only groping towards the truth, but a solution is essential for good oil field practice.

The study of the flow of these three media obviously links up with the problem of oil migration. This is a geological study and geologists must therefore be in the forefront in the investigation. As rock texture plays a fundamental part in deciding the form of the gas and oil flow, methods of extraction suitable to one type of reservoir texture may be quite inapplicable to others and only a combined knowledge of underground conditions and of the laws of flow can be the proper basis for selecting the method of oil recovery.

In the early days each well was treated as an entity and was produced as fast as possible. No attention was paid to its effect on the oil reservoir as a whole. Most drilling was competitive and few reservoirs were ever attacked with a properly arranged system of wells in orderly procedure to produce the maximum yield.

Not content, however, with the ideal of the conservation of nature's forces, the process of research in new production methods has been towards their replenishment. Thus, by introducing an external source of energy in the form of gas or by re-energizing the edge-

water drive with additional supplies of water, a still higher recovery can be attained. Gas drive, repressuring and water drive are all systems of rejuvenating and scrubbing the underground reservoir and when properly applied they have had notable success. Failures there have been, and these are in most cases due to an insufficient knowledge of the pressure conditions or of the local textural variations of the reservoir, which must always be taken into account. The right method applied in the right way and at the right time is the essential of success. One factor which in the past has militated against these methods has been the partition of oil pools into numbers of small blocks under individual ownership. Where such conditions occur it is difficult to obtain a combined and coordinated system of production within the field and nothing less than total cooperation can insure success.

A sign, however, of the growing consciousness of the advantages of unit development has been the recent tendency of the groups of individual holders to arrange for cooperative planning and secondly the adoption of state regulations forcing a system of agreed production methods and well-spacing on individual fields.

Oil geologists have played a foremost part in this tendency, for they have been in the best position to appraise the evils of the old methods and the good which would be achieved by the new. However, while the geological background is the best one for an appreciation of the evils of underground waste, it is not in itself sufficient unless associated with a keen insight into the physical processes of oil and gas movement and a practical experience of the evils of haphazard and irregular oil recovery. Underground oil waste is not always easy to see and is certainly very difficult to measure. Often when it becomes apparent it is too late to adopt remedial measures, and only by careful planning can the evils of bad development be avoided. But it is fair to state that the tendency of production methods has been to produce a marked improvement in the behavior of individual wells and we can anticipate considerable increase in the percentage of recovery which will be achieved in the future. Already there are cases where such recoveries may be as much as 700 to 900 barrels of oil to the acre-foot, which in the particular circumstances probably represents more than 50 percent of the oil underground. By the introduction of these new methods of planned oil development it is reasonable to claim that the present methods of recovery obtain at least twice as much oil from proven fields as was obtained formerly.

Geology and Drilling

In the process of the development of an oil pool, many important considerations must be carefully balanced. The thickness, porosity and permeability of the reservoir, its gas, oil and water content, and the sources of the pressure, while in addition the depth and the types of the formations which have to be drilled and therefore the economics of the drilling need to be taken into account. Some of these factors are purely economic. Generally, the geological and engineering factors dominate the issue. As, however, the engineering difficulties are mainly determined by the geological conditions, the latter usually determine the whole drilling program. Rightly conceived, this program is the fundamental framework on which the successful development of the field is based. The order of the drilling, the careful control of the oil and gas horizons from extraneous waters, and the proper utilization of the pressure systems within the reservoir rocks can only be achieved if from the very beginning the pool has been treated as a single hole. This cannot be left in the hands of an inexperienced geologist. It requires men who have a knowledge of the principles of development and also of the difficulties which will have to be faced by the engineer in carrying out the work. Not all geologists are fitted for this task. Some are peculiarly unfitted by a lack of vital interest in that borderland region where geology, physics and engineering meet. Unless they have this interest it is better for them to seek other fields of geological work.

Oil field drilling should be regarded by the oil geologist as vertical exploration. His ultimate picture must be a three-dimensional one wherein length and breadth are produced in the main by his surface studies and depth is the result of intelligent anticipation guided by the careful analysis of borehole results.

Each new well must fit into the three-dimensional picture and as drilling proceeds and the records at depth accumulate, it is nearly always found that the surface geology will need revision to become co-ordinated with the underground discoveries. New faults often come to light in the drilling data: that is, if the latter are properly examined and interpreted. They give clues to features in the surface geology which may have been overlooked or could not be properly interpreted, and the exploitation geologist should not be satisfied until all his surface and underground evidence can be welded into one complete whole. To achieve this with the maximum celerity often requires field studies on a much broader scale than the particular area in which he is interested, for only by such extensive work can the stratigraphic variations in the underground strata be investigated with intelligence. The thickness and the types of the formations, the changes in their characteristics, and the presence of unconformities, etc., are all essential parts of his framework. Some of the evidence comes from the wells, some of it comes from regional studies; both lines of attack need be continuously coordinated.

Unfortunately, the geologist is nearly always pitted against lack of data. He must therefore use the smallest clues and adopt all the means he can to obtain confirmatory evidence. To do so means that he must get behind the facts and obtain as early as possible a sound picture of the stratigraphical history of the area wherein the whole structure becomes the result of a series of events in which the sedimentation and earth movement play their coordinated part. In this work the geologist must realize that while his proper function is to obtain an accurate picture of the reservoir, he can only do so by wholehearted cooperation with the other technicians who are carrying out the work of development. His science enables him to be of great service to the drillers. His assumption of the depths and thicknesses of formations, the type of drilling conditions which will be met, the presence of underground waters, gas and oil becomes the basis of a proper drilling and casing program to which the drill has to work. His emphasis on the geological information which he requires and the amount of coring to be done, will set an additional strain on the drilling program which he must take care to appreciate. Deviations from the vertical require surveys of boreholes and certain tolerances must be allowed in each well. Finally, the carrying out of geophysical surveys of the complete or semi-drilled hole, particularly the electrical surveys, have to be decided by the geologist, and the results of these require his interpretation. The conclusion from all these studies becomes part and parcel of the final history of the reservoir.

So far, the question of oil field waters has only been alluded to briefly. In actual fact, such waters often demand the major part of an oil geologist's attention. Apart from the question of obtaining waters for drilling purposes, which may or may not become a geological problem, there are the whole series of top, intermediate and bottom waters which are associated with the oil field reservoirs and which have to be identified, studied, and ultimately shut off or controlled. Should this not be done there is always serious danger of damage to the oil and gas horizons.

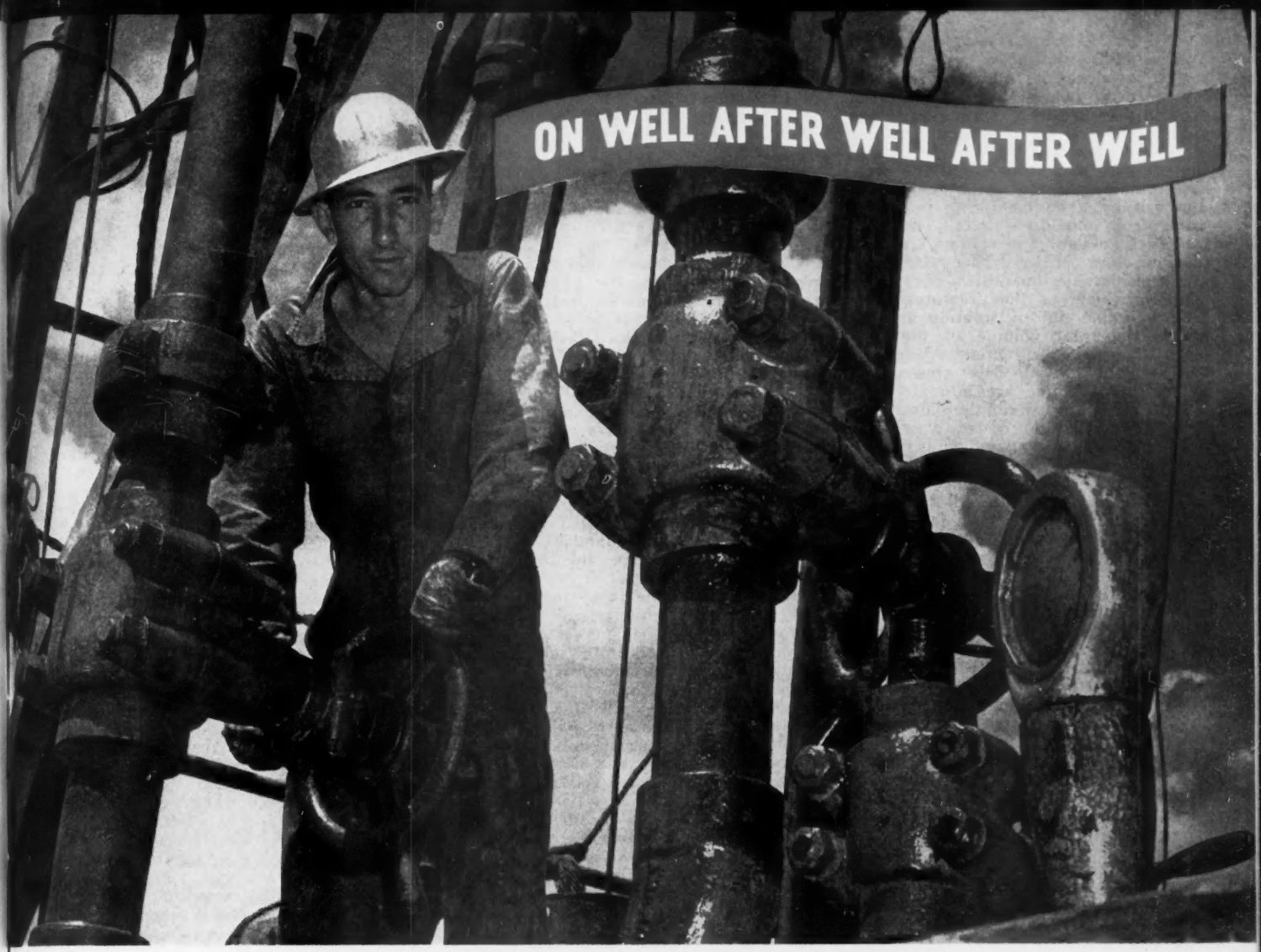
At later stages in the exploitation of a field these waters and their contained pressures may be utilized to increase oil recovery, but apart from the use of edge water drive, the main reaction to all waters in the early stages of exploitation is to shut them off completely. Much of the evidence with regard to these waters is obtained during the drilling phase. The problems occur throughout the whole history of the field, but particularly in the later stages.

Summarizing the above, it may be said that the duties of an oil geologist during the drilling phase are to plan the whole drilling program, to facilitate the operations of drilling, to protect the oil and gas reservoirs from extraneous fluids and to collect all the available data so that he can obtain a complete record of the structure, together with a detailed knowledge of the texture and liquid contents of the reservoir.

Geology and Exploitation

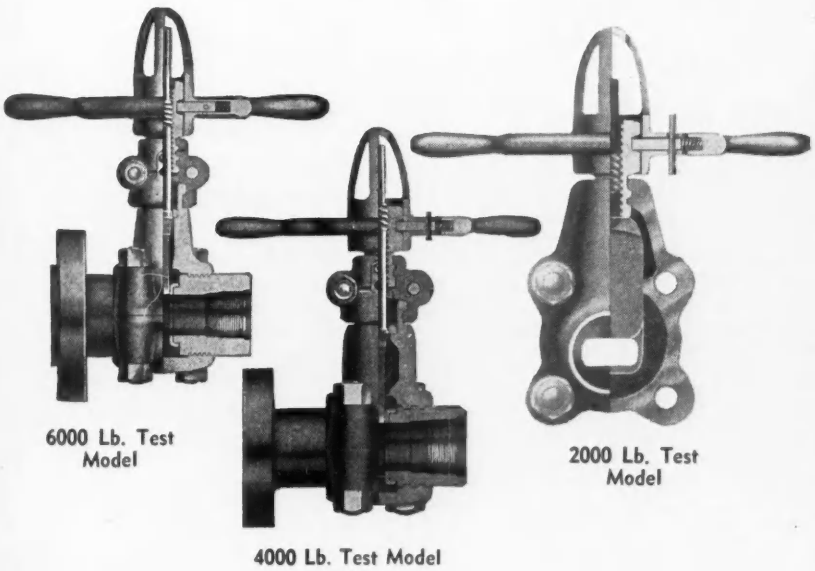
It is usual for a field to be exploited as it is being drilled, though not necessarily at the same rate. There are therefore obvious overlaps between the work of the geologist in drilling and in production. Most of the data accumulated during drilling are obviously going to be of first importance in planning the production campaign. Once a well has been drilled and is brought into production its behavior becomes a clue to what is happening in the gas, oil and water in the reservoir below. Its bottom hole pressure, tubing and casing pressures, the oil yield, the gas-oil ratio and the percentage of water which may come up with the oil, are all important lines of evidence which must be tabulated and continuously watched. To the engineer, these material facts are of importance in governing his daily production program. To the geologist, their significance lies mainly in the changing conditions within the reservoir as it is drilled up and produced.

Each barrel of oil brought to the



Cameron "Flex-Seals"

GO ON SEALING



6000 Lb. Test Model

2000 Lb. Test Model

4000 Lb. Test Model

Here's a pair of Cameron "Flex-Seal" Valves on a double standpipe manifold that have seen a lot of rough service on a lot of deep Gulf Coast wells, and they're still providing pressure-tight seals when called upon. The reason why these and all other Cameron "Flex-Seals" go on sealing long after conventional valves and stop cocks have cut out is the unique design which employs a renewable resilient flow-way insert to provide a seat for the gate and absorb the abrasive action of the fluid. When finally worn out after long service, this insert may be easily replaced at the rig by any member of the crew with ordinary rig tools. There are no metal-to-metal seals, which, when damaged, require shopping for repairs.

Cameron "Flex-Seal" Valves were designed expressly for mud line service. They are "specialists" at dealing with abrasive fluids, so try them on your rig for low cost, trouble-free service.

See your Composite Catalog for complete details or descriptive literature will gladly be sent on request.

CAMERON IRON WORKS, INC.

711 MILBY ST., HOUSTON, TEXAS

Export: 74 Trinity Place, New York, N. Y. *West Texas:* Telephone 1710, Odessa, Texas. *Oklahoma:* 310 Thompson Bldg., Tulsa. *California:* H. G. (Jeff) Musolf, 1442 Hayes Ave., Long Beach (7-2036).

surface produces its quota of effect in the reservoir below shown either as a drop in pressure or a diminution in the volume. Thus if the volume of gas and oil in the reservoir remains constant, the pressure must drop, or if the pressure remains constant the volume must diminish by a compensating inflow of water from outside sources. These relations of pressure and volume are complicated, however, by the fact that there are considerable quantities of gas in solution which, as the pressures drop, tend to come out of solution and increase the total volume of the contents. Thus the extraction of oil and gas and the loss in field pressure or in reservoir volume are intimately related but not always simple phenomena.

As the wells get older and their drainage areas expand, considerable modifications of the gas, oil and water zones may become evident with resulting alterations in the flow of the gas and oil. Some of these factors are controllable; for instance, by the use of check valves on the flow lines the rate of gas and oil to individual wells can be controlled, and such measures have their proportionate effects on the reservoir underground. By a selection of the wells to be tapped and by varying the levels within the reservoir from which the oil or gas are taken, further measures of control can be achieved; thus the whole program of exploitation is one of selective drilling and selective control of the individual producing horizons. Often individual wells may be completely closed if by so doing pressure can be conserved within the field. The aim is to take out the oil contents in such a manner that the extraction of oil per unit area is as high as possible and the pressures are conserved to the last possible moment to reduce the cost of extraction. Economic factors always enter into this consideration and limit the degree of recovery which can be obtained.

Such general programs of oil recovery can only be carried out if the whole field or structure can be treated as a unit or a collection of units. Obviously, many oil fields are so broken up structurally or stratigraphically that they contain many units of production. Each sand body, for instance, can be treated separately, and if the sands are extensive and the structure broken by faults, each individual sand compartment on the fault blocks may in the ultimate analysis become an individual unit. But this does not alter the general tenor of the consideration that unless these units are so small that they only cover the drainage area of individual wells, the basis of exploitation must be a program based on the reservoir unit. Space does not permit a discussion of the principles underlying these production methods, nor is it always possible to select the most suitable method of exploitation in individual cases until the drilling has accumulated sufficient evidence to study the behavior of the reservoir. In general, however, the principles are quite simple. They are the conservation of the energy within the reservoir whereby the gas is forced to bring its quota of oil to the surface, or alternatively the edge water is controlled and forced to flush the oil towards the production wells.

The whole science of exploitation is really an application of the physical laws of oil migration to the reservoir. However, as the reservoir is not simple it would be fatal to leave this process of extraction entirely to the physicist, for it requires continuous consideration of what is going on within the structure of the reservoir. Experience has shown that the geologist properly grounded in physics is normally more competent an exploitation technician than the physicist with a smattering of geological knowledge.

To the normal methods of field exploitation there are now added supplementary methods of control involving the use of extraneous gas or of supplementary waters. Each of these methods can give good results when applied to suitable reservoirs, but they are not in themselves panaceas of all problems. Sometimes their introduction can be disastrous. Before such systems can be introduced careful consideration of the conditions of texture within the reservoir and of the details of geological structure need to be taken into account. It goes without saying that the above requires a far higher standard of scientific approach than the haphazard methods of the past.

In general, oil fields are now deeper and pressures are higher, and such conditions can only be successfully overcome by more accurate methods of control and measurement. Some of the modern wells exceed 10,000 feet in depth. An average well of 5000 feet is considered relatively shallow. This means that rock pressures which have to be faced within the reservoirs are commonly as high as 2000 pounds to the square inch, and may be double this figure. It is a great tribute to the oil field engineer and secondly to the exploitation geologist, who assists him to face these difficulties, that in spite of this drilling costs have gone steadily down and the tendency is always towards obtaining a greater recovery of oil per acre-foot of sand.

So far as geology is concerned, had it clung to the simple stereotyped view that it was essentially an exploratory tool and that its functions ceased after oil discovery, it would have lost a highly fruitful field of operations. The work would have been done by others, and it might not have been done so well; not because of a difference in ability, but simply because the background of geology is a necessary one to approach these problems; necessary because first and foremost the difficulties are due to the abnormalities in the texture of the oil reservoir and the history of its fluid contents. It is possible to adapt our physics and chemistry to the reservoir, but we cannot change the latter, and we must therefore make sure that we understand all its idiosyncrasies. This is a task for a geologist.

On the other hand, it must be realized that geology in the narrow sense of the term would be almost useless for this work. The technician requires a sound geological training with a good fundamental background of physics, chemistry and mathematics governing his methods and reasoning. The oil geologist cannot afford to be a specialist in biology or petrology, though such specialists are employed with the industry. He must be a sound structural and stratigraphical geologist with a good background of the basic sciences. As he will have to spend much of his time in considering physical and chemical problems even though he may have physicists and chemists to cooperate with him, he must be able to assess the value and the limitations of their contributions to his problem.

Modern oil field exploitation finds great scope for the physical or the geophysical method of investigation. This work requires specialists, for it involves the use of highly developed apparatus which with its constant improvements needs the complete attention of its operators. However, the data from such work are in the main the results of measurements applied to the rocks and must be portrayed in geological terms. The geophysicist is normally completely competent in his own geophysical environment, but often remarkably weak in dealing with the geological implications of his data. Indeed, there would seem to be some inhibition whereby the normal physical background, with its assumptions of finality, because its measurements are finite, is a most unsuitable approach for the understanding of geological phenomena. Usually the latter are the results of so many incalcuable effects of time and space that they refuse to be dramatized in mathematical form. The writer does not mean by this to decry the exceedingly valuable work which has been done by geophysicists both in oil field exploration and exploitation, but it is a remarkable fact that many of the most outstanding geophysicists in such work have been geologists, and furthermore few geophysicists will deny that in the main their instrumental work has far outstripped the progress of their interpretations. This is only to be expected, for the interpretation of geophysics must always be in geological language. It requires either a man trained in both sciences or the close collaboration of a physicist and a geologist.

Summary

The description of the work of oil field exploration and exploitation has been too brief to be adequate, but it may perhaps suffice to indicate how wide is the field and how intense the study required of the oil geologist. He is set one of the most difficult tasks which can be asked of any geologist in that his structural analysis is always tested in its weakest dimension, the vertical one. Furthermore, most of his work in the field of exploitation geology, wherein he is a guardian of the reservoir below and of its liquid contents, is in the direction of insuring that this reservoir is bled of its oil and gas on sound physical principles. This is by no means a simple matter, for it involves complicated problems in physics which are still the subject of research and detailed knowledge of rock texture and structure, often difficult to obtain.

The demand made of the geologist is in many ways opposed to the normal tendency of industrial practice. Generally in modern industry a scientist is required to specialize; each adds his quota of work in a separate self-contained unit, but in oil field exploitation we see the close collaboration of a number of different sciences and the exploitation geologist who has to combine the data of them all, is set a difficult task. Thus, necessity for coordination demands a broad and a good scientific basis, and it is a great tribute to the soundness of a geological background that in the great oil industry of the U. S. the geologist more than any other scientist has permeated the whole industry and played a leading part in its phenomenal development.

Mathematical Methods of Decline Curve Extrapolation and Reserve Calculation

By SYLVAIN J. PIRSON,
School of Mineral Industries, Pennsylvania State College

AFTER the period of erratic flow of a well there usually succeeds a period of fairly regular decline in production provided the well or field's producing methods remain fairly similar, i.e., barring the interference of proration schedule, shooting, cleaning, acidizing, backpressuring, water-flooding, repressuring, etc. This period is called a period of *settled production*, the history or past performance of which, when represented by a graph on where production is plotted vs. time (year, month, week or day), may be used advantageously for the estimation of future production and thereby for an estimation of the oil reserves at hand as well as of the individual well profitability.

Valuation methods based on production decline curves found their maximum usefulness from 1920 to 1930, the beginning of the period marking the advent of government and state taxes on oil properties. The introduction of a yearly depletion allowance made it necessary to estimate the yearly reduction in underground reserves. With the advent of proration or ratable takings on a fairly generalized scale in the main producing states in the early part of the decade following 1930, the use of decline curves lost a great deal of its usefulness in estimating reserves. However, the decline curve methods are still of considerable use in non-prorated fields of which there are still a large number and in the so-called "stripper wells" in determining reserves and the probable date of abandonment. Decline curves are of special usefulness in determining in a lease which is no longer on a paying basis, which well or wells have high producing cost per barrel of oil and which should be abandoned, thereby putting the lease back on a profitable basis.

Types of Production Decline Curves

The past production performance of a well may be represented by means of curves plotted on graph paper of various types, normally plotting the production figures in barrels on the vertical scale and the time on the horizontal scale. Needless to say, the production figures must be those obtained for equal successive periods of time. Therefore, for proper representation, adjustments should be made for unequal periods such as is the case when monthly figures are used since the number of days in a month varies from 28 to 31. Normally, a standard producing month of 30 days should be used and proportional adjustment should be made in the production figures for monthly periods of greater or smaller duration, also when a certain number of shutdowns have occurred during the month.

The various types of decline curves may be plotted on standard cartesian coordinate paper, semi-logarithmic paper or logarithmic paper, and according to their shape and configuration various deductions may be made which are to be studied in due course.

The decline curve may represent the past performance not only of a well but of several wells on a property or of an average well on that property, or of a field, or of an average well in that field.

1. Normal production decline curve: that in which the raw production figures of a well, property or field, adjusted to equal time intervals, are plotted directly on any type of coordinate paper.

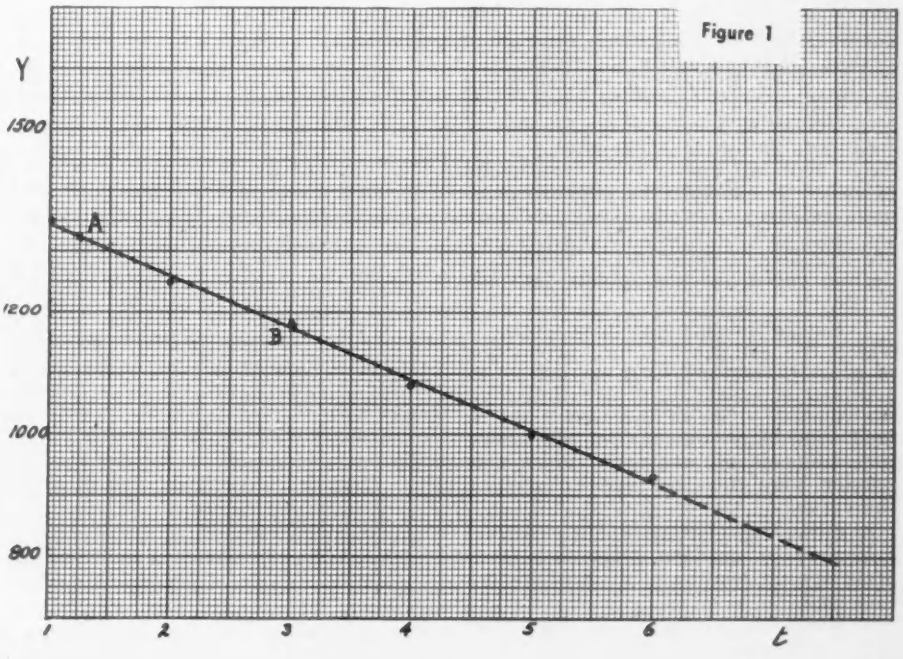
2. Percentage decline curve: that showing the decline in the production of a well, property or field where the production during the successive units of time is expressed as percentages of the production during the first unit of time which is taken as 100 percent. This type of curve is particularly useful in order to compare the rates of decline of several wells by superposing the graphs which have all the same starting point at 100 percent. It is particularly useful if one wishes to compare the effect of production potential or age of wells of similar sand conditions on the rate of decline. Originally it was believed that regardless of size or output, wells of the same age under similar sand conditions would show percentages of decline substantially equal. It was soon found, however, that the percentage of decline is related more to production potential than to age and that large capacity wells generally decline more rapidly than small wells. This is due to the more rapid depletion of reservoir energy in large wells associated with highly permeable sands.

3. Persistence curve: that in which the ratios of the production figures obtained during two successive and equal units of time are plotted versus time. If y_n represents the rate of production for a given unit of time and y_{n+1} for the succeeding unit of time, the persistence p is given by

$$p = \frac{y_{n+1}}{y_n}$$

For a well prorated to a constant output or for a well under an efficient water drive, the persistence is one. For an unrestricted well the closer the persistence of the well is to one the greater will be the ultimate recovery. Under flush and unrestricted production, the persistence between the second and first year approximates .5, thereafter the

Figure 1



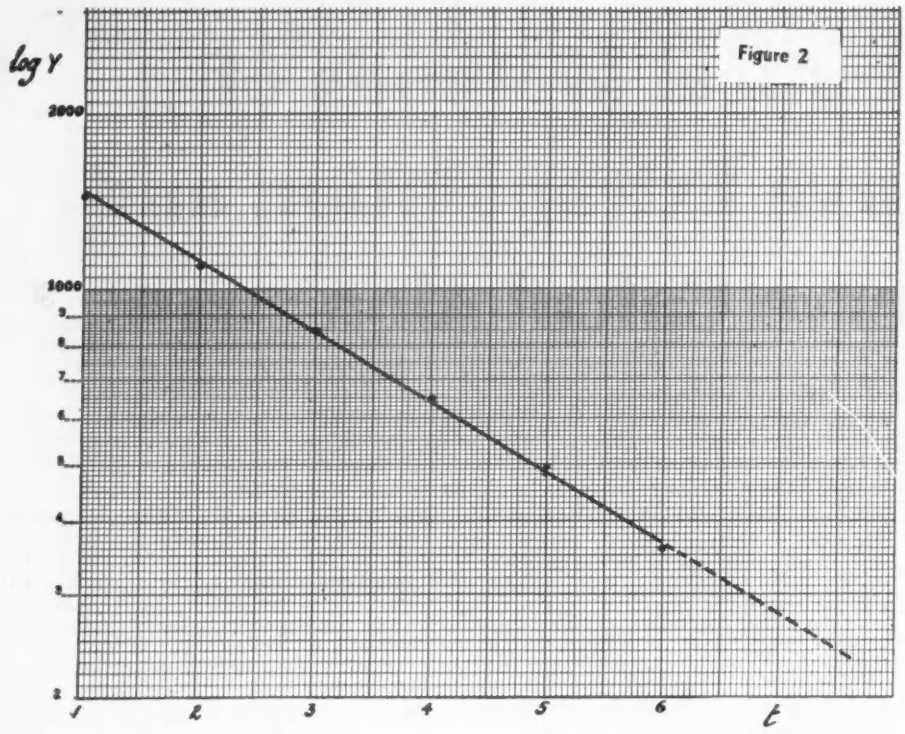


Figure 2

value of p increases asymptotically towards one.

4. Cumulative production curve: that in which the accumulated production since the start of production at any given time is plotted vs. time elapsed since production began. A similar curve may also be plotted on a percentage basis using 100 percent for the first interval of time.

5. Extrapolated production curve: that part of a production curve which has been extended into the future by means of extrapolation. Normally, the extrapolation takes place to the economic limit of production and the curve so obtained is the basis for estimating reserves recoverable at a profit.

6. Ultimate production or appraisal curve of a tract, pool or field: that in which the estimated average ultimate production to a stated economic limit of each individual well in that tract, pool or field is plotted vs. the production during the initial unit of time, usually one year. The curve is based on the extrapolation of individual production decline curves to their individual economic limit. It gives a representative curve for a tract but it is necessary to have access to a fairly large amount of well data in order to construct a reliable appraisal curve. It is very useful in order to estimate the probable ultimate recovery of wells newly drilled in the tract and for which insufficient data are available to construct a production decline curve and extrapolate into the future.

7. Future production curve: that in which the estimated future production of a well, tract or field carried to an assumed economic limit is plotted vs. the remaining life of the well, tract or field. For any number of remaining time units of life the total future production may then be read directly on the curve.

8. Other special production curves also may be used to bring into focus some special relation in the past history of a well:

a. Reservoir pressure vs. cumulative production on semi-log paper. This curve is particularly useful in estimating production in limestone reservoirs where the field is devoid of water drive.

b. Well potential vs. cumulative production on cartesian coordinates. (Siliceous lime pools in Kansas—straight line relationship with change of slope when water encroachment is effective.)

c. Percentage of energy expended vs. cumulative production on cartesian coordinate paper (used mostly in gas drive fields).

d. Daily or monthly rate of production vs. cumulative production on cartesian coordinate paper (used for waterflooding estimates).

9. Another class of production curves are those termed composite, average or family curves which represent the average performance of a tract or property, lease, field, pool or group of pools or even for a whole state. Such an average decline curve has been used for the allocation of proration production schedules on a statewide basis and is known as the "rate of withdrawal curve."

Extrapolation of Production Decline Curves

In order to estimate the future production of a well, tract, field or pool by means of production decline curves, it is necessary to project into the future the past performance of the producing unit. The accuracy and reliability of this projection depends to a large extent upon the accuracy of the production data as recorded in the past and on the judicious application of correction factors for disturbances caused by well repair jobs. The reliability of the reserve estimates will further depend on the proper use of methods of curve extrapolation. These methods may be grouped into two classes, as follows:

1. Mathematical methods.
2. Graphical methods.

Graphical methods of extrapolation of production decline curves have been adequately treated by W. W. Cutler in Bulletin 228 of the U. S. Bureau of Mines. Accordingly they will not be treated here.

Mathematical Extrapolation Methods

This group of methods is often designated as "curve fitting" or "rectification of curve" because a study of the data is made with the purpose of finding a theoretical formula which will fit closely the set of data at hand and will permit to calculate the most probable value of

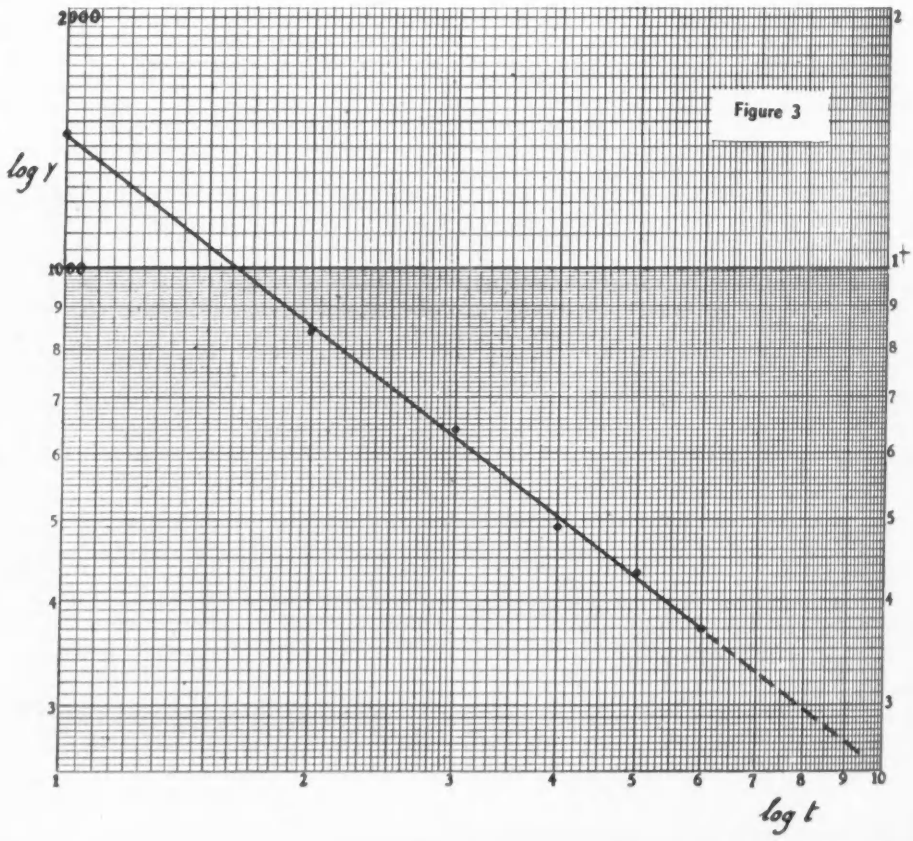


Figure 3

the formula's constants. The methods will be illustrated by means of a series of examples. Essentially, the mathematical solution of a decline curve problem involves three problems:

a. The *recognition* of the type of formula or curve which best fits the data or measurements in the present case production rate (y) in barrels per unit of time (t) chosen (year, month, week or day).

b. The *calculation* of the *arbitrary constants* which enter the formula which fits best.

c. The calculation of the expected future production or *reserves* to a given or preassumed economic limit.

Inasmuch as most of the recognition methods are based on the basic straight line problem, this case will be treated first though it is realized that straight line decline curves occur very rarely.

A. *Straight Line Decline Curve.*

a. Method of sight average. The fact that the production data approximate a straight line may be easily recognized by plotting production figures vs. intervals of time on standard cartesian coordinate paper (Figure 1). If a straight line can be passed through the data leaving as many on one side of the straight line as on the other and at distances substantially equal, an equation for this line may be easily obtained by locating two points on that straight line, A and B of coordinates $A(y_1,t_1)$ and $B(y_2,t_2)$. It must be borne in mind that the two points A and B are not necessarily some observed figures, and that most generally they will not be.

The equation of a straight line is

$$y = mt + a \qquad (1)$$

where m and a are constants to be determined by setting the following relations

$$y_1 = mt_1 + a$$
$$y_2 = mt_2 + a$$

since the straight line passes necessarily through A and B. The values of m and a are obtained from

$$m = \frac{y_1 - y_2}{t_1 - t_2} \qquad (2)$$

$$a = \frac{t_1y_2 - t_2y_1}{t_1 - t_2} \qquad (3)$$

b. Method of averages. The result of the above calculation will greatly depend on the judgment of the operator in passing a straight line through a set of points. A more accurate procedure would be to calculate coefficients m and a by means of the "method of averages." According to this procedure the following set of equations would be set up for a given number of production data:

Group 1

$$\begin{cases} y_1 = mt_1 + a \\ y_2 = mt_2 + a \\ \cdots\cdots\cdots \\ y_n = mt_n + a \end{cases} \qquad (4)$$

Group 2

$$\begin{cases} y_{n+1} = mt_{n+1} + a \\ \cdots\cdots\cdots \\ y_r = mt_r + a \end{cases}$$

and the system of equations is divided into two consecutive groups 1 and 2. It is important that the equations be written in their natural chronological sequence and that the two groups contain substantially the same number of equations. All data should be entered into relation (4) discarding only those which are very erratic.

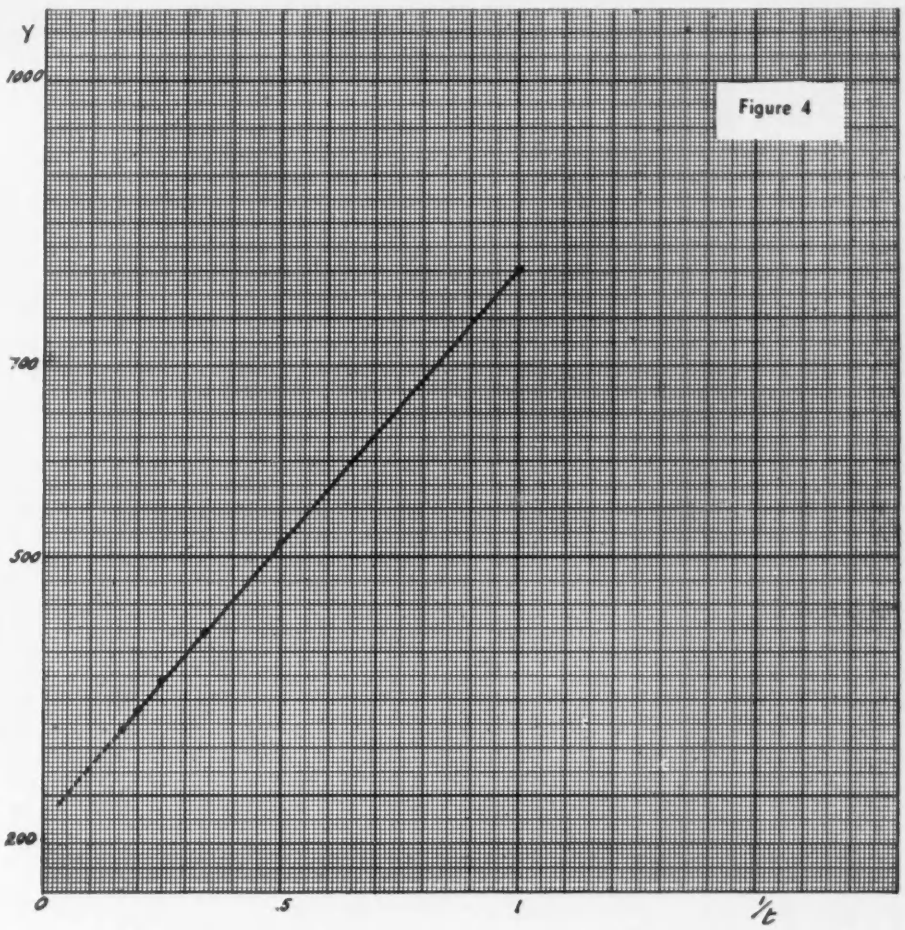


Figure 4

Two equations are now written, as obtained, one from each group by addition of the equations term by term. We obtain:

$$\sum_{j=1}^{n} y_j = m\sum_{j=1}^{n} t_j + na$$

$$\sum_{j=n+1}^{r} y_j = m\sum_{j=n+1}^{r} t_j + (r-n)a \qquad (5)$$

in which the symbols Σ represent summations over the running index j between the limits shown. A better system of solutions for m and a than previously obtained by sight average may now be obtained from

$$m = \frac{(r-n)\sum_{j=1}^{n} y_j - n\sum_{j=n+1}^{r} y_j}{(r-n)\sum_{j=1}^{n} t_j - n\sum_{j=n+1}^{r} t_j} \qquad (6)$$

$$a = \frac{\left(\sum_{j=1}^{n} t_j\right)\left(\sum_{j=n+1}^{r} y_j\right) - \left(\sum_{j=n+1}^{r} t_j\right)\left(\sum_{j=1}^{n} y_j\right)}{(r-n)\sum_{j=1}^{n} t_j - n\sum_{j=n+1}^{r} t_j} \qquad (7)$$

Although the values of m and a obtained by the method of averages will be more reliable than those obtained when drawing a straight line through the plotted data, the method of averages is still open to the objection that a large number of solutions from m and a, however, differing little from each other, are possible according to the selected method of grouping the equations 4. Two appraisers using the same grouping, however, should find identical answers.

c. Method of least squares. A method of calculating m and a which is not open to the above objection and which gives, at the same time, a solution which is the most probable one, is known as the "Method of Least Squares." If y_e is the experimental value of the production, i.e., that actually measured in the field, whereas y_t is the theoretical value of the production, i.e., that obtained by reading it from the curve representing the production decline, the most probable decline curve is that one which will render minimum the sum of the square of the residuals:

$$\Sigma (y_t - y_e)^2$$

We have:

$$\Sigma (y_t - y_e)^2 = \Sigma (a + mt - y_e)^2 \qquad (8)$$

in which the unknown variables are a and m. If expression (8) is to be a minimum as a and m vary, we have:

$$\frac{\partial}{\partial a}\Sigma(a + mt - y_e)^2 = 0$$
$$\frac{\partial}{\partial m}\Sigma(a + mt - y_e)^2 = 0 \qquad (9)$$

If the summations in equations (9) extend from 1 to n where n is the number of production figures available, we have:

$$na + m\sum_{j=1}^{n} t_j = \sum_{j=1}^{n} y_{ej}$$

$$a\sum_{j=1}^{n} t_j + m\sum_{j=1}^{n} t_j^2 = \sum_{j=1}^{n} y_{ej}\, t_j \qquad (10)$$

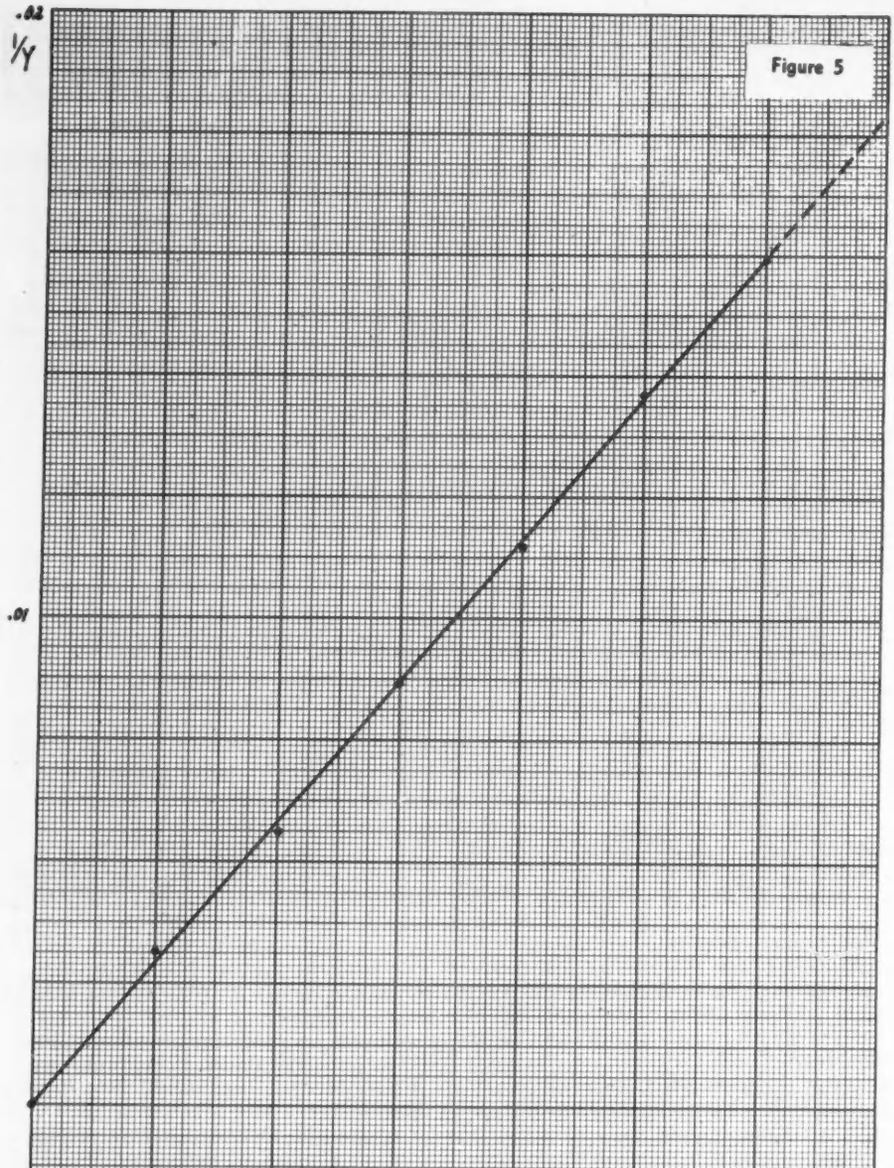


Figure 5

Equations (10) form a simultaneous system of equations in a and m, the solutions of which are:

$$a = \frac{\left(\sum_{j=1}^{n} t_j^2\right)\left(\sum_{j=1}^{n} ye_j\right) - \left(\sum_{j=1}^{n} ye_j\, t_j\right)\left(\sum_{j=1}^{n} t_j\right)}{n\sum_{j=1}^{n} t_j^2 - \left(\sum_{j=1}^{n} t_j\right)^2} \qquad (11)$$

$$m = \frac{n\sum_{j=1}^{n} ye_j\, t_j - \left(\sum_{j=1}^{n} t_j\right)\left(\sum_{j=1}^{n} ye_j\right)}{n\sum_{j=1}^{n} t_j^2 - \left(\sum_{j=1}^{n} t_j\right)^2}$$

Example 1—An oil well has been completed for six months and it has produced the following output of oil adjusted to a standard 30 day month:

1st month .....1350 bbls.
2nd month .....1250 bbls.
3rd month .....1180 bbls.
4th month .....1080 bbls.
5th month .....1000 bbls.
6th month ..... 930 bbls.

Verify that the above figures approximate a straight line decline curve on cartesian paper and calculate the equation representing the performance of this well by means of the three methods here above discussed: method of sight averages, method of averages, and method of least squares.

The data of this problem were used in plotting Figure 1 where the straight line was drawn by sight averaging. The coordinates of points A and B are respectively

$$A \begin{cases} t_1 = 1.25 \\ y_1 = 1325 \end{cases} \qquad B \begin{cases} t_2 = 3.0 \\ y_2 = 1175 \end{cases}$$

Equations (2) and (3) give

$$m = -85.7$$
$$b = 1432$$

and the equation of the decline curve is:

$$y = 1432 - 85.7\,t$$

By the method of averages, the data are divided in two equal groups of three equations, as follows:

Group 1:
$$1350 = m + a$$
$$1250 = 2m + a$$
$$1180 = 3m + a$$
$$3780 = 6m + 3a$$

Group 2:
$$1080 = 4m + a$$
$$1000 = 5m + a$$
$$930 = 6m + a$$
$$3010 = 15m + 3a$$

Solving for a and m by (6) and (7), we obtain

$$a = 1431 \qquad m = -85.6$$

The solution by the method of least squares may be obtained most readily by computing the data as shown in Table 1.

TABLE 1

Time t_j	Production Rate y_j	t_j^2	$y_j t_j$
1	1350	1	1350
2	1250	4	2500
3	1180	9	3540
4	1080	16	4320
5	1000	25	5000
6	930	36	5580
$\sum_{j=1}^{n} t_j = 21$	$\sum_{j=1}^{n} y_j = 6790$	$\sum_{j=1}^{n} t_j^2 = 91$	$\sum_{j=1}^{n} y_j t_j = 22{,}290$

Substituting in equations (11), we obtain

$$a = 1428$$
$$m = -84.3$$

and the most probable law of decline is

$$y = 1428 - 84.3 \times t$$

There is a further problem connected with the extrapolation of decline curves which is that of estimating future reserves by adding up the future production figures obtained by extrapolation up to and including the "economic limit."

The economic limit of a well is the stage at which no profit can be realized from the recovery and sale of oil or gas. The usual policy is to extract oil and gas until the income from sales does not warrant maintenance of the well. This throws the burden of recovery, transportation, marketing or other incidental expenses connected with production from a property or field onto the larger and more profitable wells. The economic limit for each well in a tract or pool is therefore not a constant quantity but will vary with every well as the latter shares an increasing amount of the operating expense burden when other wells are withdrawn from production. It is, therefore, important to keep complete statistics on the cost of production per field and to have a knowledge of their distribution per well. The economic limit of a well will normally be calculated on the basis of the average for the previous year and figures are available from the statistical department of the oil companies. If we have the following information:

e = operating cost per well per month
P = market price per barrel
r = royalty rate
t = production tax

the economic limit E.L. in barrels per day is obtained from

$$E.L. = \frac{e}{30 \times P(1-r)\,(1-t)} \qquad (12)$$

for an average month of 30 days.

The reserves of oil producible from a

well by means of the operating methods which have created the performance on which the decline curve is based may be established by calculating the expected production rate at each of the intervals of time separating the time at which the economic limit will be reached. In the case of the straight line decline curve the time $t_{E.L.}$ at which production should be discontinued under penalty of losing money is obtained from:

$$E.L. = m\, t_{E.L.} + a \qquad (13)$$

$$\text{or} \quad t_{E.L.} = \frac{E.L. - a}{m}$$

If $t_{E.L.}$ is not an integer, production should be stopped at a time just before reaching $t_{E.L.}$ which gives a whole number which we shall call t_f. The available reserves R are therefore:

$$R = y_i + y_{i+1} + \text{---------} + y_f = \qquad (14)$$

where subscript i refers to the expected production during the first interval of time after the date of the estimate and f to the final production figures. Subscripts i and f are also integer numbers which respectively indicate the number of time units elapsed since the beginning of production to the start and finish of the reserve span. Therefore, by substitution, we obtain

$$R = m[i + (i+1) + \text{----} + f] + (f - i + 1)a \qquad (15)$$

The term between brackets in (15) is the difference of two arithmetic series:

$$A_f = 1 + 2 + 3 + \text{----} + f = \frac{f(f+1)}{2}$$

$$A_{i-1} = 1 + 2 + 3 + \text{----} + (i-1) = \frac{(i-1)\,(i)}{2}$$

Thus, we have for the reserves of oil

$$R = \frac{m}{2}[f\,(f+1) - (i-1)\,(i)] + (f - i + 1)a \qquad (16)$$

Example 2—Calculate the reserves of oil producible from the well of Example 1, assuming that the market price of oil is $1.20 per barrel, the royalty rate 12.5 percent and the tax rate 5 percent on gross production. It is further estimated that the operating costs of the well will remain constant at $300 per year for the life of the well.

The economic limit is calculated as follows:

$$E.L. = \frac{300/12}{30 \times 1.20\,(1 - .125)\,(1 - .05)} = .833 \text{ bbls./day.}$$

or 25 bbls./month.
Hence,

$$t_{E.L.} = \frac{25 - 1428}{-84.3} = 16.63 \text{ months.}$$

t_f will then be chosen as 17 months. Applying equation (16), we find for the reserves:

$$R = \frac{-84.3}{2}[17 \times 18 - 6 \times 7] + (17 - 7 + 1)\,1428 = 4598 \text{ bbls.}$$

B. *Exponential Decline Curve*

$$y = a\,e^{-bt} \quad \text{or} \quad y = a\,10^{-bt}$$

In order to recognize if the well production data approximate an exponential curve all that is needed is to plot them on semi-logarithmic paper and they should fall on or at least approximate a straight line. The equation of a sloping straight line on semi-logarithmic paper, decreasing for increasing values of t, may be written as follows:

$$\text{Log}_e y = \text{Log}_e a - bt \qquad (17)$$

$$\text{or} \quad \text{Log}_{10} y = \text{Log}_{10} a - bt \qquad (18)$$

Semi-logarithmic paper is that on which one axis is to a cartesian and the other to a logarithmic scale. Therefore, logy and Loga may be plotted or read directly in constructing the curve representing the performance of the well.

Since an exponential decline curve is a straight line on logarithmic paper, the principles explained above for determining the coefficient a and m of a straight line from experimental data are applicable here to the determination of Log a and b.

Once Log a and b have been determined by either one of the above three methods, the reserves R may be calculated if one knows the economic limit E.L. and the time of abandonment t_f. The derivation of a reserve formula for exponential decline curves is as follows:

If one takes two subsequent production figures:

$$y_j = a\,e^{-btj}$$

$$y_{j+1} = a\,e^{-b(t_{j+1})}$$

and make their ratio, we obtain

$$\frac{y_{j+1}}{y_j} = e^{-b} = \text{Constant} \qquad (19)$$

which indicates that the ratio of any two consecutive production figures is a constant or that a well declining at constant rate is a straight line when plotted on semi-logarithmic paper. The rate of decline r, may be obtained from:

$$r = \frac{y_j - y_{j+1}}{y_j} = \frac{e^{-btj} - e^{-b(tj+1)}}{e^{-btj}} = 1 - e^{-b} \qquad (20)$$

Hence,

$$y_{j+1} = y_i(1-r) = y_j(e^{-b})$$

The table of production figures is as follows:

$t_j = i$	$y_i = y_{i-1}(1-r)$
$= i+1$	$y_{i+1} = y_{i-1}(1-r)^2$
$= i+2$	$y_{i+2} = y_{i-1}(1-r)^3$
- - - - - - - - - - - - - - - - -	
$= f$	$y_f = y_{i-1}(1-r)^{f-i+1}$

Therefore, the producible oil reserves are:

$$R = \sum_{j=i}^{f} y_j = y_{i-1}(1-r)\,[1 + (1-r) + (1-r)^2 + \text{------} + (1-r)^{f-i}]$$

The finite series between brackets may be considered as the difference of two infinite series as follows:

$$R = y_{i-1}(1-r)\{[1 + (1-r) + (1-r)^2 + \text{------} + (1-r)^{\infty}] - (1-r)^{f-i+1}[1 + (1-r) + \text{------} + (1-r)^{\infty}]\}$$

These infinite series are converging and have a definite numerical value provided $/1 - r/ < 1$ which will generally be the case in a declining production curve. Each series converges to

$$\frac{1}{1-(1-r)} = \frac{1}{r}$$

and the final expression for the reserves may be written as:

$$R = y_{i-1}(1-r) \times \frac{1 - (1-r)^{f-i+1}}{r}$$

$$= y_{i-1}e^{-b}\,\frac{1 - e^{-b(f-i+1)}}{1 - e^{-b}}$$

$$R = a\,e^{-bi}\,\frac{1 - e^{-b(f-i+1)}}{1 - e^{-b}} \qquad (22)$$

or in the case of a base 10 formula:

$$R = a\,10^{-bi}\,\frac{1 - 10^{-b(f-i+1)}}{1 - 10^{-b}} \qquad (22^1)$$

Due to the readiness with which exponential curves are extrapolated and the results calculated, semi-logarithmic paper is much in favor for individual well reserve estimation regardless of whether the exponential curve fits the data or not. This slovenliness in valuation work yields to the early abandonment of wells as the production rate of a well toward the end of its economic life is more sustained than indicated by a constant rate decline curve. It is extremely important that the proper type of curve be recognized that fits the production data at hand, thereby leading to the proper use of graph paper for the presentation of the data. Carefulness in the preliminary work will lead to the economical production of many barrels of oil which otherwise would have been left in the ground unrecovered by primary production methods.

Example 3—Given the following monthly production figures:

t	y
1	1450 bbls.
2	1100 bbls.
3	850 bbls.
4	650 bbls.
5	495 bbls.
6	360 bbls.

show that they fit an exponential decline curve and calculate the coefficients of the equation by the method of averages. Assuming an economic limit of one barrel per day, what are the oil reserves of this well which are producible by methods used during the last six months?

The data of this example were used in plotting the curve of Figure 2 where the straight line was drawn by sight averaging and which constituted the recognition that the data plotted an exponential decline curve of the type $y = a\,10^{-bt}$. Table 2 and the set of equations were drawn up.
When solving the equations shown in Table 2 by the method of averages, we obtain:

$$a = 1912 \qquad b = .1187$$

and the decline curve equation becomes:

$$y = 1912\ 10^{-.1187t}$$

For an economic limit of 30 barrels a month the date of abandonment is obtained by solving $30 = 1912\ 10^{-.1187t}$ E.L. which gives $t_{E.L.} = 15.2$ months. Thus t_f will be chosen at 15 months.

By equation (22) the reserves are:

$$R = 1912 \times 10^{-.1187 \cdot 7} \frac{1 - 10^{-(15-7+1) \times .1187}}{1 - 10^{-.1187}} = 1095 \text{ bbls.}$$

Rem.: It is interesting to compare the result obtained by formula (22) with that which would be obtained according to Arps' proposal (J. J. Arps—Analysis of Decline Curves—AIME T. P. 1758—September, 1944) who suggests using as the reserves the finite integral of the decline curve equation between the initial and final times of the reserve span. One obtains according to Arps:

$$R = \int_1^f a\ 10^{-bt}\ dt = \frac{a}{b\ \log_e 10} 10^{-b(f-1)} = \frac{1912}{2.3 \times .1187} \times 10^{-.1187(16-7)} = 788 \text{ bbls.}$$

which is 307 bbls. less than the correct computation by equation (22). This dis-

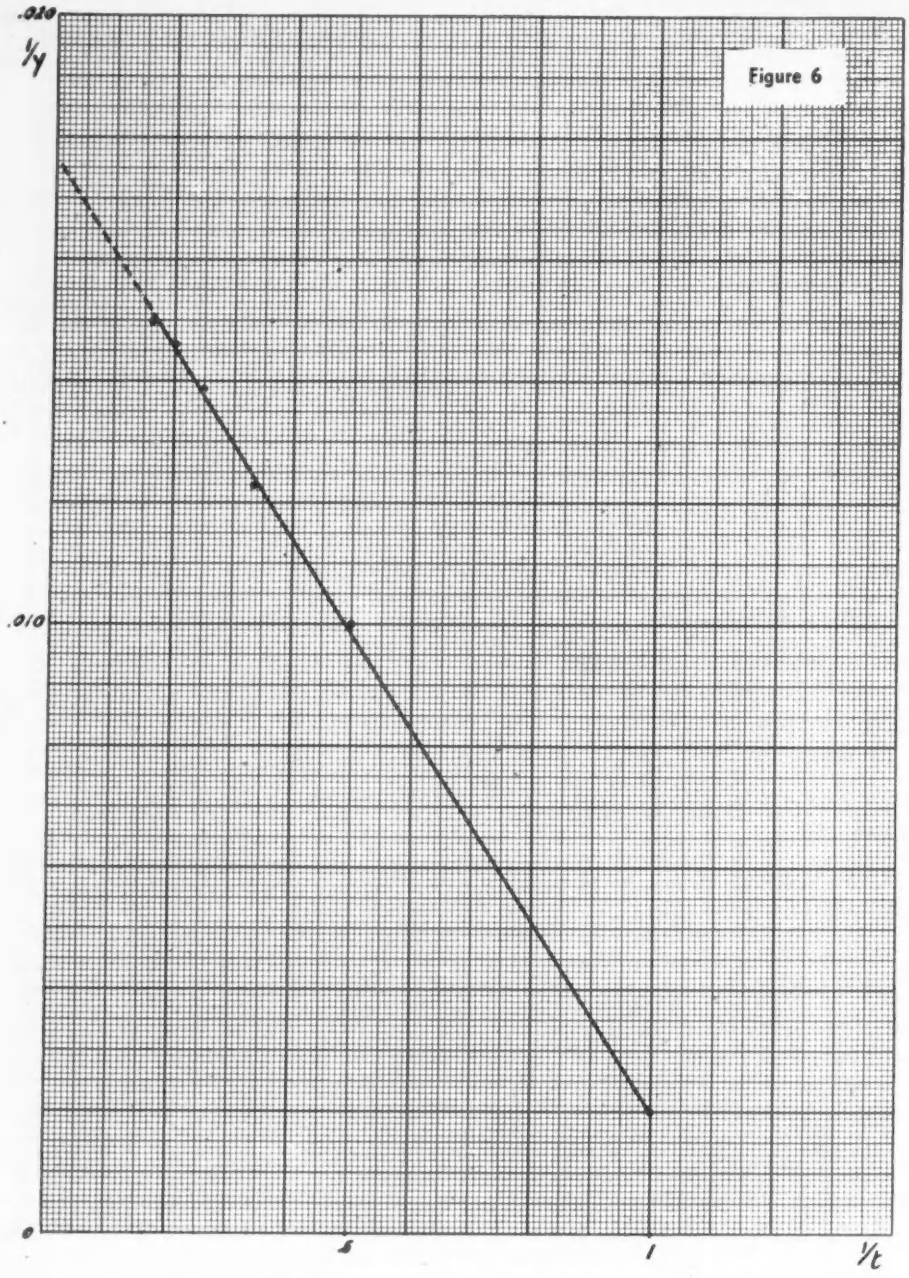


Figure 6

crepancy will be accounted for in the next case where it will be shown that the integral of the decline curve must be corrected by $\frac{y_i + y_f}{2}$ in order to derive a closer approximation to the reserves.

C. *Parabolic Decline Curve*—$y = at^{-b}$

If the production data can be fitted by means of a parabolic curve, this fact may be recognized by plotting the data on double logarithmic paper (Log-Log paper or simply logarithmic paper) on which both scales are logarithmic. Taking the $\log_e$ of both sides of the parabolic relation $y = at^{-b}$, we have:

$$\text{Log}_e y = \log_e a - b \log t \quad \text{or}$$
$$\text{Log}_{10} y = \text{Log}_{10} a - b \log_{10} t \qquad (23)$$

Therefore, this type of parabolic curve will be a straight line when plotted on log-log paper, and the parameters $\underline{\log a}$ and $\underline{b}$ may be calculated by one of the methods explained for determining the parameters of a straight line decline curve.

Once the parameters $\underline{\log a}$ and $\underline{b}$ have been so determined, the reserves $\underline{R}$ may be calculated if one knows the Economic Limit E.L. and the time of abandonment t_f. The derivation of a reserve formula for a parabolic decline curve is as follows:

If $\underline{i}$ represented the initial time at which the reserves are to be estimated and $\underline{f}$ the time at the economic limit we have:

$$y_i = a\ i^{-b}$$
$$y_i + 1 = a(i+1)^{-b}$$
$$y_i + 2 = a(i+2)^{-b}$$
$$\cdots\cdots\cdots$$
$$y_f = a\ f^{-b}$$

$$R = \sum_{j=i}^{f} y_i = a[i^{-b} + (i+1)^{-b} + (i+2)^{-b} + \cdots + f^{-b}] \qquad (23')$$

TABLE 3

Value of the Sum of the First n Terms of a Harmonic Series

Number of Terms in the Series	Sum H_n	Number of Terms in the Series	Sum H_n
1	1.000000	26	3.854422
2	1.500000	27	3.891459
3	1.833333	28	3.927173
4	2.083333	29	3.961656
5	2.283333	30	3.994989
6	2.450000	31	4.027247
7	2.592857	32	4.058497
8	2.717857	33	4.088800
9	2.838968	34	4.118212
10	2.928968	35	4.146783
11	3.019877	36	4.174561
12	3.103210	37	4.201588
13	3.180133	38	4.227904
14	3.251562	39	4.253545
15	3.318229	40	4.278545
16	3.380729	41	4.302935
17	3.439553	42	4.326745
18	3.495109	43	4.350001
19	3.547741	44	4.372728
20	3.597741	45	4.394950
21	3.645360	46	4.416689
22	3.690815	47	4.437966
23	3.734293	48	4.458799
24	3.775960	49	4.479207
25	3.815960	50	4.499207

This finite series for the expression of the reserves may not be evaluated accurately by simple mathematical means. However, a good approximation may be obtained by the reverse problem of graphical integration by means of the trapezoidal rule. According to this rule if an interval of time (if) is divided into a finite number of equal intervals

$$(i,\ i+1,\ i+2,\ \text{-----},\ f-1,\ f)$$

the integral of the function y between the limits i and f is obtained by the summation $\sum_{j=i}^{f} y_i$ to which must be added a correction term $\frac{y_i + y_f}{2}$ which takes into account the curvature of the curve. Hence:

$$R = \sum_{j=i}^{f} y_i = \int_i^f y\,dt + \frac{y_i + y_f}{2}$$
$$= \frac{a}{1-b}[f^{1-b} - i^{1-b}] + \frac{y_i + y_f}{2} \qquad (23'')$$

Example 4—Given the following monthly production figures:

t	y
1	1450 bbls.
2	840 bbls.
3	640 bbls.
4	490 bbls.
5	430 bbls.
6	370 bbls.

show that they fit a parabolic decline curve and calculate the coefficient of the equation by the method of averages. Assuming an economic limit of one barrel per day, what are the oil reserves

TABLE 2

t	y	$\log_{10} y$		Equations	
1	1450	3.1614		$3.1614 = \log_{10} a - 1\,b$	
2	1100	3.0414	I	$3.0414 = \log_{10} a - 2\,b$	$9.1322 = 3\log_{10} a - 6b$
3	850	2.9294		$2.9294 = \log_{10} a - 3\,b$	
4	650	2.8129		$2.8129 = \log_{10} a - 4\,b$	
5	495	2.6946	II	$2.6946 = \log_{10} a - 5\,b$	$7.0638 = 3\log_{10} a - 15b$
6	360	2.5563		$2.5563 = \log_{10} a - 6\,b$	

of this well producible by methods used during the last six months?

The data given are plotted on log-log coordinates in Figure 3 from which it may be seen that they fit a straight line in a satisfactory manner.

The application of the method of averages to the production figures yields immediately the following values:

$$a = 1480$$
$$b = .778$$

By substitution of the monthly economic limit of 30 barrels into $y = 1480\,t^{-.1587}$, the value of f is computed as 150.
Hence, by application of 23"), the reserves are

$$R = \frac{1480}{1-.778}[150^{1-.778} - 7^{1-.778}] + \frac{325+30}{2}$$
$$= 10{,}177 \text{ bbls.}$$

D. *Hyperbolic Decline Curves*

A hyperbolic curve is that in which the product of the production figures (y) by the time (t) appears in the formula representing the curve. There are various types of such curves which may be encountered in practice and the following methods are used for their recognition.

(Type 1) $y = a + \frac{b}{t}$

It may be ascertained that the production data of a well follow this relation by plotting the raw production figures versus $\left(\frac{1}{t}\right)$ on cartesian coordinate paper. If the point falls on a straight line, the representative curve is of this type. The values of a and b may again be calculated by any one of the methods reviewed for fitting a straight line to a set of data.

Once the parameters a and b have been determined a formula for the reserves may be established if one knows the economic limit and the time t_f of abandonment. The derivation of the reserve formula is as follows:

If i represents the initial time at which the reserves are to be established and f the time at the economic limit, we have:

$$y_i = a + \frac{b}{i}$$
$$y_i + 1 = a + \frac{b}{i+1}$$
$$y_i + 2 = a + \frac{b}{i+2}$$
$$\cdots\cdots\cdots\cdots$$
$$y_f = a + \frac{b}{f}$$

Therefore,

$$R = \sum_{j=i}^{f} y_i = (f - i + 1)a + b\left(\frac{1}{i} + \frac{1}{i+1} + \cdots + \frac{1}{f}\right) \quad (24)$$

The finite series of formula 24 is the difference of two harmonic series, as follows:

$$H_f = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} \cdots\cdots + \frac{1}{f}$$

$$H_{i-1} = 1 + \frac{1}{2} + \frac{1}{3} + \cdots\cdots + \frac{1}{i-1}$$

The value of these finite harmonic series may be read directly from Table 3.

The reserve figures may then be obtained from

$$R = (f - i + 1)a + (H_f - H_{i-1})b \quad (25)$$

A good approximation to the reserve figures may again be obtained by the reverse graphical integration formula, as follows:

$$R = \int_i^f y\,dt + \frac{y_i + y_f}{2}$$
$$= \int_i^f \left(a + \frac{b}{t}\right)dt + \frac{y_i + y_f}{2}$$
$$= a(f - i) + b \log_e \frac{f}{i} + \frac{y_i + y_f}{2} \quad (25')$$

Example 5—Given the following monthly production figures:

t	y
1	800 bbls.
2	515 bbls.
3	420 bbls.
4	370 bbls.
5	340 bbls.
6	320 bbls.

show that they fit Type 1 hyperbolic decline curve and calculate the coefficients of the equation by the method of averages. Assuming an economic limit of eight barrels per day, what are the oil reserves of this well which are producible by methods used during the last six months?

It is first recognized that the production data of Example 5 fit a production decline curve of Type 1 by plotting them on cartesian graph paper as shown on Figure 4, where 1/t and y are the coordinates.

The coefficients a and b as obtained by the method of averages are as follows:

$$a = 224$$
$$b = 580$$

The date of abandonment f is obtained by substituting for y the monthly economic limit 240 barrels in

$$y = 224 + \frac{580}{f}$$

one obtains f = 36 months.
The computation of the reserves by (25) yields

$$R = (36 - 7 + 1)\,224 + (4.174561 + 2.592857)\,580 = 7719 \text{ bbls.}$$

By formula (25'), we obtain

$$R = 224\,(36 - 7) + 580 \log_e \frac{36}{7} + \frac{307 + 240}{2} = 7723 \text{ bbls.}$$

(Type 2) $y = \frac{1}{a + bt}$

It may be ascertained that the production data of a well follow this relation by plotting the reverse of the raw production figures $\left(\frac{1}{y}\right)$ versus time (t) on cartesian coordinate paper, since this type of hyperbolic curve may be written as follows:

$$\frac{1}{y} = a + bt$$

The points so obtained will fall on a straight line and the parameters a and b may be calculated by the usual methods.

A good approximation to the reserve figure may again be arrived at by the reverse trapezoidal integration rule, namely

$$R = \int_i^f \frac{dt}{a + bt} + \frac{y_i + y_f}{2} = \frac{1}{b} \log_e \frac{a + bf}{a + bi} + \frac{y_i + y_f}{2} \quad (26)$$

Example 6—Given the following monthly production figures:

t	y
1	500 bbls.
2	225 bbls.
3	154 bbls.
4	111 bbls.
5	91 bbls.
6	72 bbls.

Show that they fit Type 2 hyperbolic decline curve and calculate the coefficients of the equation. Assuming an economic limit of one barrel per day, what are the oil reserves of this well, producible by practice in effect during the last six months?

It is first recognized that the production data of Example 6 fit a production decline curve of Type 2 by plotting them on Figure 5 where $\left(\frac{1}{y}\right)$ and (t) are the axes of coordinates.

The coefficients a and b are then calculated to be respectively —.0003 and .0023. An economic limit of one barrel per day will then be reached, when

$$30 = \frac{1}{-.0003 + .0023f} \text{ or for } f = 16$$

The reserves, by formula (26), are

$$R = \frac{1}{.0023} \log_e \frac{-.0003 + .0023 \times 16}{-.003 + .0023 \times 7} + \frac{63 + 30}{2} = 456 \text{ bbls.}$$

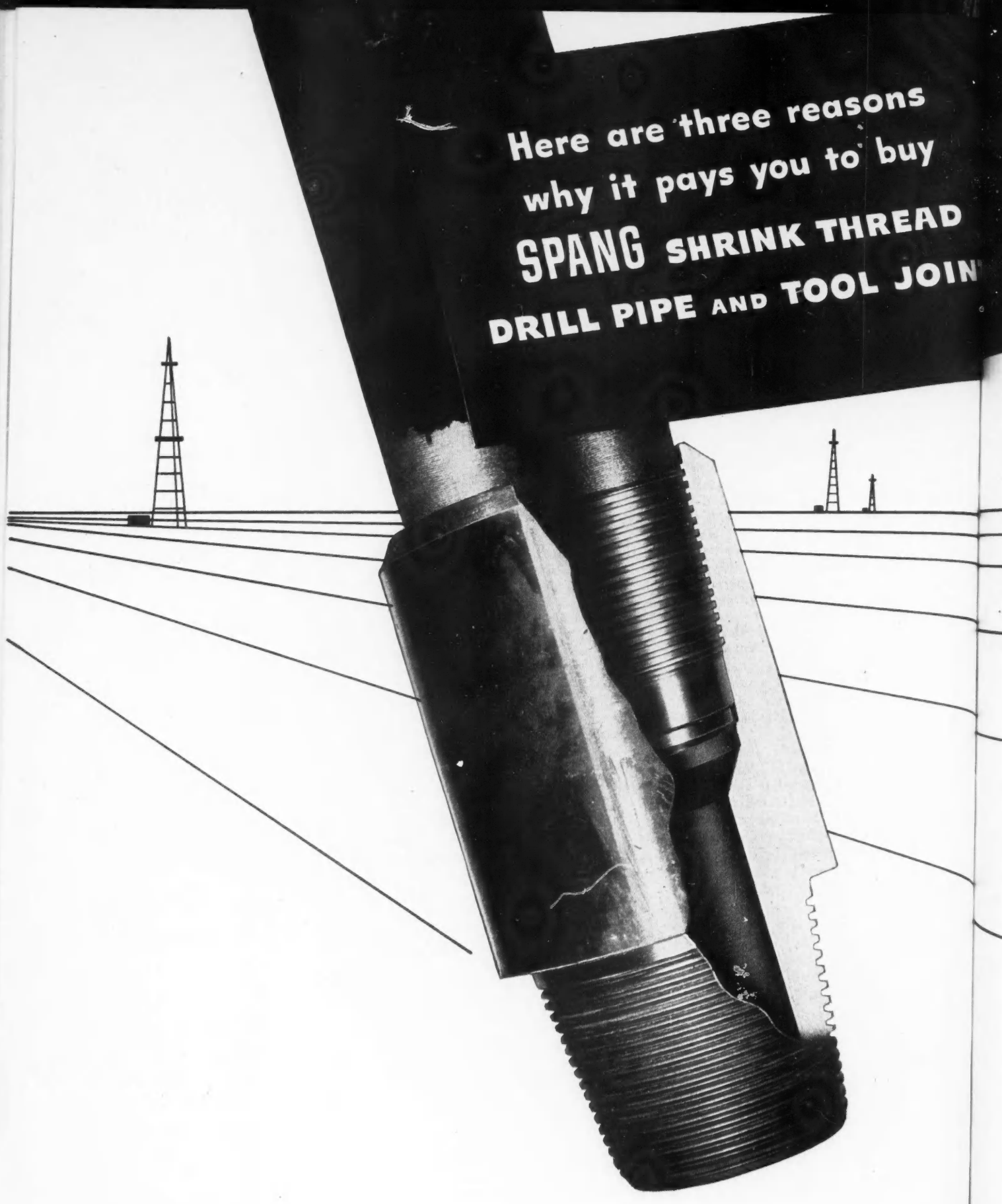
(Type 3) $y = \frac{t}{a + bt}$

It may be determined that the decline curve of a well follows this relation by plotting the reverse of the production figures $\left(\frac{1}{y}\right)$ versus the reverse of time $\left(\frac{1}{t}\right)$ on cartesian coordinate paper, since this type of hyperbolic curve may be written as follows:

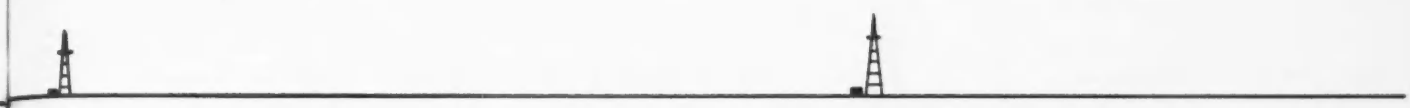
$$\frac{1}{y} = b + a\frac{1}{t}$$

which is a straight line when $\left(\frac{1}{y}\right)$ is plotted versus $\left(\frac{1}{t}\right)$ on coordinate paper.

Coefficients a and b may again be determined by one of the methods previously studied for the straight line re-



DISTRICT SALES OFFICES: ATLANTA; BOSTON; CHICAGO; DENVER; DETROIT; HOUSTON; LOS ANGELES; NEW YORK; PHILADELPHIA; PITTSBURGH; ST. LOUIS; SAN FRANCISCO; TULSA.



Both drill pipe and tool joint are completely controlled by one company from engineering research and design through all manufacturing processes to the finished product.

The precision assembly of this drill pipe and tool joint assures the user of maximum efficiency and uniform strength throughout the string.

Because this unit is manufactured and controlled by one company there is the added advantage of dealing with one reliable source of supply — one order to place — and one company responsibility.

EXECUTIVE OFFICES
PITTSBURGH, PA

SPANG·CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

lationship. The reserve figure may be arrived at by the reverse trapezoidal integration rule, namely

$$R = \int_i^f \frac{t}{a+bt}\,dt + \frac{y_i + y_f}{2} = \frac{1}{b^2}\left[b(f-i) - a \log_e \frac{a+bf}{a+bi} \right] + \frac{y_i + y_f}{2} \qquad (27)$$

Example 7—Given the following monthly production figures:

t	y
1	500 bbls.
2	100 bbls.
3	81 bbls.
4	72 bbls.
5	69 bbls.
6	67 bbls.

Show that they fit Type 3 hyperbolic decline curve and calculate the coefficients of the equation. Assuming an economic limit of two barrels per day, what are the oil reserves of this well producible by practice in effect during the last six months?

By plotting the production data of Example 7 in the manner shown in Figure 6 it may be seen that they fit a hyperbolic curve of Type 3. The coefficients a and b have been calculated to be respectively —.0156 and .0176. Hence an economic limit of one barrel a day will be reached when

$$30 = \frac{f}{-.0156 + .0176f}$$

or for f = 17 months.

The reserves, as obtained by formula 27, are

$$R = \frac{1}{(.0176)^2}\left[.0176\,(17-7) + .0156 \log_e \frac{-.0156 + .0176 \times 17}{-.0156 + .0176 \times 7} \right] + \frac{65+30}{2} = 680 \text{ bbls.}$$

Generalized Simple Decline Curves

It may be observed that Types 1 and 2 hyperbolic decline curves could have been plotted as straight lines on log-log paper. In fact Type 1 may be written as follows:

$$y - a = \frac{b}{t}$$

or

$$\log(y-a) = \text{Log } b - \log t$$

which evidently is the equation of a straight line on log-log paper.

Similarly Type II may be written

$$y = \frac{1/b}{\frac{a}{b} + t}$$

or

$$\log y = \log\left(\frac{1}{b}\right) - \log\left(t + \frac{a}{b}\right)$$

which would also plot as a straight line on log-log paper.

In the first case a straight line is obtained by shifting the curve by an amount a in the direction of the y axis, in the latter case by shifting the curve by an amount $\frac{a}{b}$ along the time axis.

When the production data are given the appraiser, these shifts are unknown but it may be surmised that the curves are rectifiable on log-log paper when an appreciable shift in the plot of the curve, either horizontally or vertically, will result in a reverse curvature.

A hyperbolic equation with a number of arbitrary coefficients may then be written and their value determined by the methods previously studied. A general hyperbolic equation which may be fitted to the data is as follows:

$$y + a = \frac{b}{c + d\,t}$$

where a, b, c and d are arbitrary parameters which will fit the data.

Similar remarks would apply to generalized parabolic and exponential decline curves where a rectification becomes possible with either a vertical or horizontal shift or both. The equation would then be respectively:

$$y + a = b(t+c)^{-d}$$

and

$$y + a = b\,e^{-c(t+d)}$$

E. *Complex Parabolic Decline Curves*

Certain types of production decline curves are so complicated that they may not be fitted by any of the preceding formulae and some special type of mathematical or graphical analysis must be resorted to in order to extrapolate them.

(Type 1) $y - a = k(t-b)^{-n}$

This type of hyperbolic decline curve is a straight line on log-log paper, since

$$\log(y-a) = \log k - n \log(t-b)$$

Unfortunately, the inclusion of the constants a and b introduces computation difficulties and the graphical methods of extrapolation are much simpler to apply. Essentially, the graphical method consists in shifting the plot of the data, by adding a constant to y or t in such a manner that the curve will be straight on log-log paper. The constants a and b having been so determined, the values of k and n may be calculated by methods of straight line fitting of a set of data as previously studied.

(Type 2)

$$y = a + bt + ct^2 + dt^3 + \text{-------}$$

This type of curve which may be termed the polynomial decline curve can be conveniently extrapolated by what is known as the "method of differences" when the production data at hand are equally spaced in time as is normally the case for yearly, monthly, weekly or daily figures. For monthly figures, it is necessary to adjust the data to a standard month of 30 days.

If one sets up the following table of differences:

t	y	$\Delta^1 n = y_n - y_{n-1}$	$\Delta^2 n = \Delta^1 n - \Delta^1 n_{-1}$	$\Delta^3 n = \Delta^2 n - \Delta_{n-1}$	$\Delta^4 n = \Delta^3 n - \Delta^3 n_{-1}$
1	y_1				
2	y_2	$y_2 - y_1$			
3	y_3	$y_3 - y_2$	$y_3 - 2y_2 + y_1$		
4	y_4	$y_4 - y_3$	$y_4 - 2y_3 + y_2$	$y_4 - 3y_3 + 3y_2 - y_1$	
5	y_5	$y_5 - y_4$	$y_5 - 2y_4 + y_3$	$y_5 - 3y_4 + 3y_3 - y_2$	$y_5 - 4y_4 + 6y_3 - 4y_2 + y_1$
6	y_6	$y_6 - y_5$	$y_6 - 2y_5 + y_4$	$y_6 - 3y_5 + 3y_4 - y_3$	$y_6 - 4y_5 + 6y_4 - 4y_3 + y_2$
7	y_7	$y_7 - y_6$	$y_7 - 2t_6 + y_5$	$y_7 - 3y_6 + 3y_5 - y_4$	$y_7 - 4y_6 + 6y_5 - 4y_4 + y_2$

it can be shown that if the last column of differences is a constant ($\Delta^4 n = k$), then the set of data may be represented by $y = a + bt + ct^2 + dt^3 + et^4$. Should the third differences be constant ($\Delta^3 n = k$), then the data could be represented by a parabola of the third order: $y = a + bt + ct^2 + dt^3$. Similarly, if $\Delta^2 y = k$, then $y = a + bt + ct^2$ and, if $\Delta^1 y = k$, then $y = a + bt$. Having determined the power order of the formula, one may proceed to determine the coefficients of the variables. An observation which yields a simplification of the calculations permits the determination of the coefficient of the highest power which is equal to the value of the constant in the last column divided by the factorial of the order number of the highest power. More generally, the coefficient of t^n is $\frac{K}{n!}$ where K is the average value of the column of nearly constant differences.

Example 8—Given the following monthly production figures:

t	y
1	1000 bbls.
2	900 bbls.
3	809 bbls.
4	726 bbls.
5	650 bbls.
6	580 bbls.

show that the data fit a parabolic curve of the third order and determine the equation that fits the data. Also calculate the reserves to an economic limit of one barrel a day.

The table of differences is set up as follows:

t	y	Δ^1	Δ^2	Δ^3
1	1000			
2	900	—100		
3	809	—91	9	
4	726	—83	8	—1
5	650	—76	7	—1
6	580	—70	6	—1

Since the column in Δ^3 is a constant the curve has the general form $y = a + bt + ct^2 + dt^3$. The value of d is (—1/6), therefore we can set up the following system of simultaneous equations in order to calculate the coefficients of the equation:

$$\left.\begin{aligned} 1000 &= a + b + c - 1/6 \\ 900 &= a + 2b + 4c - 8/6 \\ 809 &= a + 3b + 9c - 27/6 \end{aligned}\right\} \qquad (28)$$

The group of simultaneous equations (28) gives the following results:

a = 1110 b = 115.33 c = 5.5

yielding the equation:

$$y = 1110 + 115.33\,t + 5.5\,t^2 - 1/6t^3$$

This equation may now be used for the calculation of the reserves. This is most readily done by means of the reverse graphical integration rule as follows:

$$R = \frac{y_i + y_f}{2} + \int_i^f (a + bt + ct^2 + dt^3 \quad)dt = \frac{y_i + y_f}{2} + a(t_f - t_i) + \frac{b}{2}(t_f^2 - t_i^2) + \frac{c}{3}(t_f^3 - t_i^3) + \frac{d}{4}(t_f^4 - t_i^4)$$

y_f will be found to be 55 barrels for $t_f = 15$ and by substitution we obtain $R = 2250$ bbls. However, it is simpler to make the following considerations. Since Δ^3 is constant, it will also stay constant in the future and, therefore, the table can be extended very simply by filling in the future values of Δ_1 and Δ_2 and calculating the corresponding values of y, as follows:

t	y	Δ^1	Δ^2	Δ^3
7	515	—65	5	—1
8	444	—61	4	—1
9	386	—58	3	—1
10	330	—56	2	—1
11	275	—55	1	—1
12	220	—55	0	—1
13	164	—56	—1	—1
14	106	—58	—2	—1
15	45	—61	—3	—1

Production will be stopped after the fifteenth month if the economic limit is one barrel per day as the value of $\Delta^1 16$ is (—65) and $y_{16} = -20$.

In practice, it is seldom that a column of differences will be exactly constant as in the preceding example. For the purpose of extrapolating production data, it will be sufficient if there exists a column where these figures will remain sensibly constant. An average will then be taken, and the extrapolation carried as if the column had shown constant figures, by either calculating the coefficients of the representative equation or by table extrapolation.

Loss Ratio Method

The loss ratio method of extrapolating decline curves, which was originally proposed by R. H. Johnson in 1927, is a special way of using the method of differences. Instead of proceeding to calculate differences on the raw production figures, the various orders of differences are calculated on the ratio of the raw figures to their corresponding time increment. Mathematically, the loss ratio method substitutes the analysis of the decline curve as such by the study of the mathematical properties of the function $r = \frac{y}{\Delta y}$ where y is the yield of the well in barrels per unit of time and Δy is the difference between the yield of two successive time units. The loss ratio method is very similar in its application to the method of differences and the estimation of future reserves does not require the complex computation of constants of a formula. It assumes, however, that the future performance of the producing well will obey the discovered law as it should if no abnormal changes in the mechanical and subsurface sand conditions of the well take place. It is well, however, to know the type of curve which is being extrapolated under varying conditions. The setting up in columns of the following functions:

$\Delta r, \quad \Delta^2 r \ldots\ldots \Delta^n r$

representing respectively differential variations per unit of time in r, $\Delta r, \ldots\ldots \Delta^{n-1} r$, is equivalent to the study of the first derivative, second derivative, ... curves. In the application of the loss ratio method we look for a simple law (generally the constancy of the values) regulating the columns whose headings are Δy, r, Δr, $\Delta^2 r$, ... $\Delta^n r$.

It was shown in another publication (Sylvain J. Pirson—Production Decline Curves May Be Extrapolated by Loss Ratio—*The Oil and Gas Journal*, November 14, 1935, p. 34-35) that the loss ratio method is able to extrapolate decline curves of a high degree of complexity. When the column of Δy is a constant the decline curve is obviously a straight line. If the ratio $r = \frac{y}{\Delta y}$ gives a constant, the curve is an exponential with a constant percentage rate of decline. The constancy of any one of the columns of differences computed on r, such as $\Delta^1 r$, $\Delta^2 r$, $\Delta^3 r$, etc. permits the extrapolation of higher degree decline curves with possible irrational exponents. Then, the determination of the analytic form of the decline curve becomes a hopeless task in actual practice and it is advisable to extrapolate by tabulation. An example will more clearly indicate the procedure.

Example 9—Extrapolate the following production figures by means of the loss ratio method.

EXAMPLE 9

Month	Production y	Δy	$r = \frac{y}{\Delta y}$	$\Delta^1 r$	$\Delta^2 r$	$\Delta^3 r$
1	15,000.0					
2	7611.0	7389.0	1.03			
3	4977.0	2634.0	1.89	.86		
4	3677.5	1299.5	2.83	.94	.08	
5	2921.0	756.5	3.86	1.03	.09	.01
6	2433.0	488.0	4.99	1.13	.10	.01
7	2096.0	337.0	6.23	1.24	.11	.01
8	1852.0	244.0	7.59	1.36	.12	.01

In this example, it may be seen that the various values of $\Delta^1 r$, $\Delta^2 r$, $\Delta^3 r$, and r, are obtained by continuing them as arithmetic series, the interval between the terms of the series being the figures found in the next column on the same horizontal line.

The production figures y are obtained from the following relation:

$$r_n = \frac{y_n}{y_{n-1} - y_n} \text{ or } y_n = y_{n-1}\left(\frac{r_n}{r_n + 1}\right)$$

in which n designates the order or the elapsed time since the beginning of production.

The high degree of sensitivity of this method, which is also one of its main limitations, may be observed by studying the effect of a small deviation from the figures shown for n = 7 and 8 as follows:

Month	y	Δy	$r = \frac{y}{\Delta y}$	$\Delta^1 r$	$\Delta^2 r$	$\Delta^3 r$
7	2095	338	6.20	1.21	.08	—.02
8	1853	242	7.67	1.47	.26	+.18

This indicates that an error of less than .1 percent in the measurement of the production figures will disturb considerably the constancy of the last column. This is because, in the value of r, Δy appears in the denominator and, as this quantity becomes smaller and smaller for settled production, any error made in the measurement is magnified in the corresponding value of r.

As said above, the data must be unusually good for the application of loss ration extrapolation.

The above objection may be partially removed by using, as a ratio, $R = \frac{\Delta y}{y}$ in which erratic measurements will have less influence. This may be termed the *"reverse loss ratio method."* The general extrapolation procedure would be similar to the loss ratio method proposed by Johnson, and it is illustrated as follows:

Example 10—Extrapolate the following production figures by means of the reverse loss ratio method.

EXAMPLE 10

Month	Production y	Δy	$R = \frac{\Delta y}{y}$	$\Delta^1 R$	$\Delta^2 R$	$\Delta^3 R$
1	1000.0					
2	573.0	427	.745			
3	358.0	215	.601	.144		
4	248.0	110	.444	.157	.013	.004
5	153.0	95	.618	.174	.017	.004
6	85.0	68	.813	.195	.021	.004
7	41.7	43.3	1.033	.220	.025	.004

The values of $\Delta^1 R$, $\Delta^2 R$, $\Delta^3 R$, and R, are again obtained by continuing the arithmetic series into the future.

The production figures y are now obtained from the following relation:

$$\frac{y_{n-1} - y_n}{y_n} = R_n \quad \text{or} \quad y_n = \frac{y_{n-1}}{R_n + 1}$$

in which n designates the elapsed time since the beginning of production.

Conclusions

Mathematical methods of decline curves extrapolation may appear to be somewhat involved and slow in practical use. Yet they permit a most com-

■ CONTINUED ON PAGE 59

Big Slush Pump

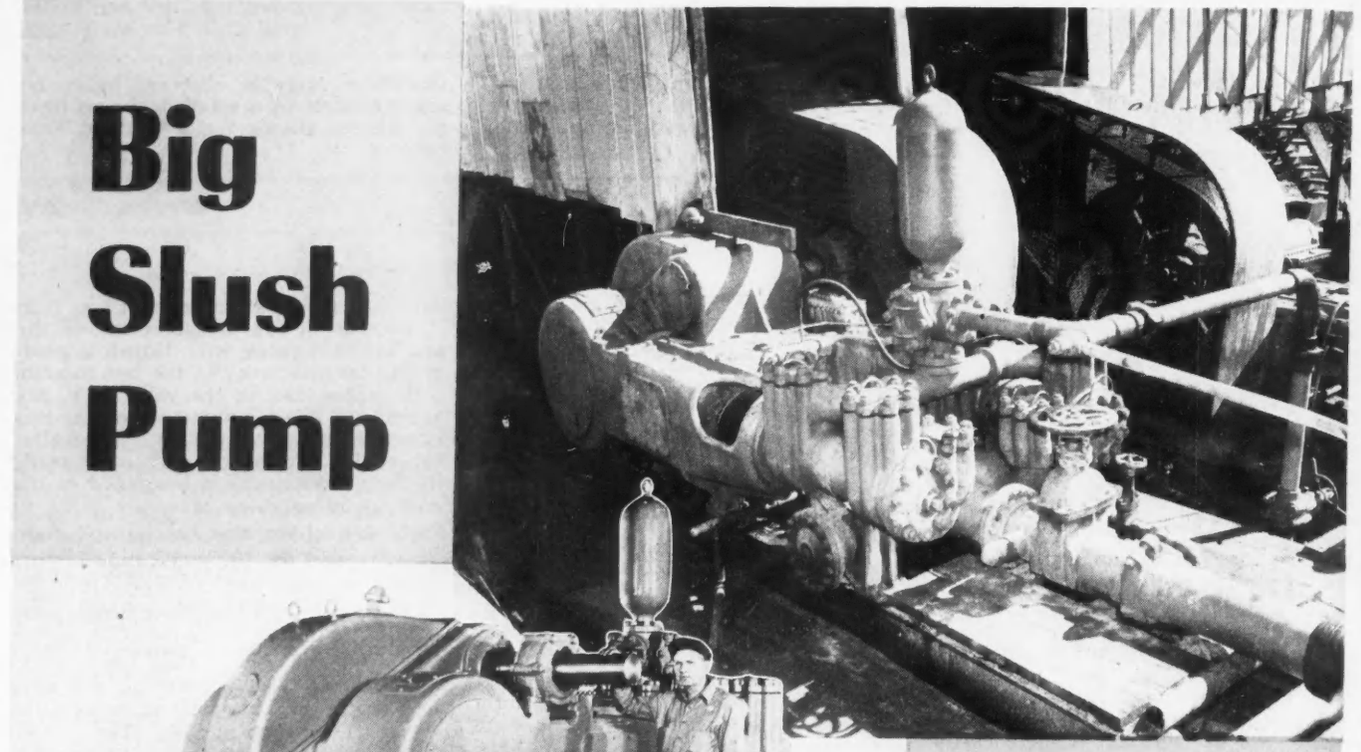


Figure 1. Actual installation view of new 600-horsepower slush pump on location at North Texas wildcat test. Photo at lower left shows power end and relative size as compared to a 6-foot man.

By J. E. KASTROP, Staff Writer

THE ability to circulate large mud volumes at high pressure while running at slow speeds is a salient feature of the world's largest slush pump. This recently introduced duplex power-driven pump is capable of transmitting almost 600 horsepower into the drilling fluid circulatory system. This makes it possible to handle high viscosity fluids at great depths with less concern for overburdening pumping equipment or sticking drill pipe.

Since early December, 1945, Falcon Seaboard Drilling Company has been using the pump on a wildcat in North Texas where its performance to a depth of about 11,000 feet has been satisfactory. Features of large volumes at high pressures are "paying off" at this depth, according to the operators. Compounding of the mud pumps has been unnecessary with its present performance. During the past nine months of operation, little trouble has been experienced. A standby mud pump was used on numerous occasions as a relief for the 600-horsepower pump, but no major breakdowns have occurred. As a result of this "test" period, the pony rod (connecting the cross head with the piston rod) had to be enlarged slightly in diameter to carry the load safely. Table 1 shows average operating data during drilling of this wildcat. The figures pertain primarily to the heavy-duty mud pump here described; however, reports indicate that the standby pump was used in drilling less than ten percent of the total footage (11,000 feet at the time data were obtained).

Performance Data

In Figure 2, it will be noted that 763 gallons of mud per minute are delivered with a 7¾-inch piston at 55 strokes per minute with permissible pressures up to 1118 pounds per square inch. A maximum permissible pressure of 2910 pounds per square inch is developed by the five-inch diameter piston which delivers 295 gallons per minute at the rated speed of 55 strokes per minute. These figures are based on 100 percent volumetric efficiency up to maximum permissible pressures indicated for each size liner.

Pump Design

The power end of the duplex, double acting pump is of the overhanging crank type. Weighing more than 40,000 pounds, the weight per horsepower is approximately 67 pounds. The main framework is a one-piece casting of high-strength alloy iron. Ribs and sections in the frame provide a rigid structure to resist deflection and to prevent bearing or gear misalignment. The gears are totally enclosed by walls cast into the main frame and in the cover to eliminate oil leakage and the entrance of mud or grit into the bearing case. Full roller bearings are provided throughout this new pump.

The fluid end is cast steel machined for precision alignment. The mud valves and seats are located in eight individual valve pots which are readily accessible by removing the valve covers. Each cover is provided with handles to facilitate removal. Inlet valves have been placed inboard of the cylinders and near the fluid intake level to reduce the suction head as much as possible. Ample room between the two cylinders permits accessibility to all parts of the fluid end for repair or inspection. The suction manifold has been designed so that "in-line" suction may be made from either side or directly in front of the pump. (The fluid end is assumed to be the front end.) Such design reduces the number of turns required in the intake line, and thus reduces the suction head that results in increased volumetric efficiency. The exhaust manifold cross-head connection is provided with a four-

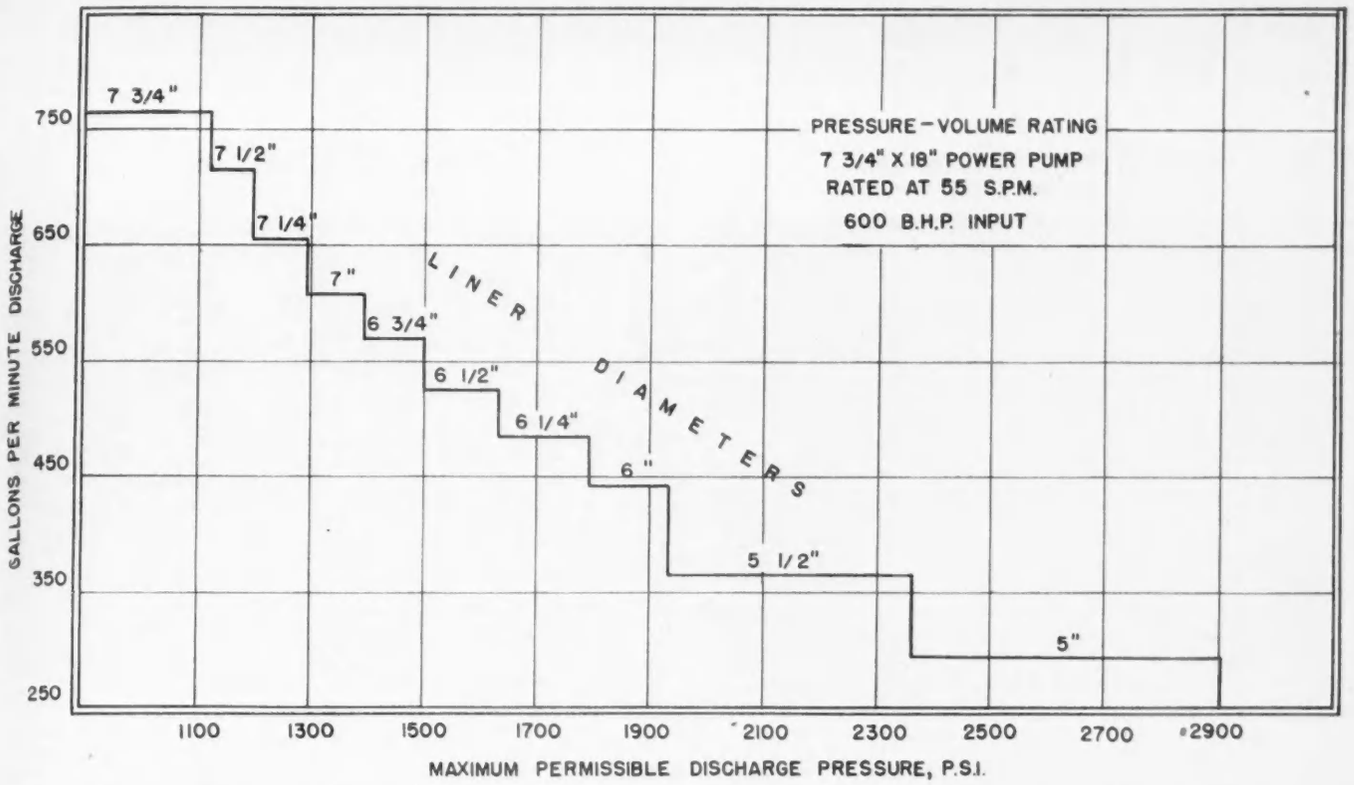


Figure 2. Based on a volumetric efficiency of 100 percent, this curve shows volumes and maximum permissible pressures developed when using the indicated liners on the 600-horsepower mud pump.

way port, making it possible to lead off with the discharge mud line from any of the four outlets. Construction of the discharge and suction manifolds in the manner described forms a flexible installation with a minimum of pipe turns.

The fluid liners are provided with two rubber packing sleeves which prevent the mud from cutting around the liners, and makes possible the use of "tell-tale" holes or ports between the packing elements as a direct means of determining when leakage begins. The liners are held in place by a basket type retainer which is secured and adjusted by one outside set screw in the cylinder head as shown in Figure 1.

Though the power shaft and "V" belt pulley are shown mounted on the left side of the pump, the assembly may be mounted on the opposite side to suit any rig layout plan. Roller bearing mounts are provided on both sides to care for either installation.

As pointed out above, the gears are lubricated by an oil bath that is totally enclosed to prevent contamination. A drain plug and filling plug make it possible to replace the oil periodically. Each roller bearing is equipped with a pressure connection to furnish an ample supply of fiber grease to these critical points. The upper and lower crosshead slides are provided with a wash of oil while the piston rods in the chevron-type packed stuffing box are lubricated with a force-feed oil pump.

Duplex construction, slow speed operation, 100 percent roller bearing equipped, overhanging crank type, sturdy frame casting and large volumes at high pressures are features of the new slush pump that aid in drilling deep wells.

Table 1. ACTUAL PUMPING DATA

7¾-inch x 18-inch 600-hp Power Slush Pump

Depth Interval (Feet)	Liner Size (Inches)	Pump Pressures (Lbs./Sq. In.)	Pump Strokes Per Minute	Mud Weight (Lbs./Ga.)	Mud Viscosity (Secs.)
0— 1,000	7¾	350	50	.....	.....
1,000— 2,000	7¾	500	50	....	....
2,000— 3,000	7¾	550	50	....	....
		(Set 13⅜-inch Casing at 2600 feet)			
3,000— 4,000	7¾	600	40	9.8	34
4,000— 5,000	7¾	700	40	9.8	36
5,000— 6,000	7¼	800	46	9.8	42
6,000— 7,000	7¼	800	46	10.0	53
7,000— 7,500	6¾	900	46	10.2	100
7,500— 8,000	6¾	900	46	9.7	100
		(Set 9⅝-inch casing at 8,200 feet)			
8,000— 8,500	6¾	950	46	9.7	47
8,500— 9,000	6¾	900	44	9.9	62
9,000— 9,500	6¾	1000	46	9.8	70
9,500—10,000	6¾	1000	46	9.8	70
10,000—10,500	6¾	1200	46	10.0	65
10,500—11,000	6¾	1200	46	10.0	63

Sun's Veteran Record

More than one-fourth of all Sun Oil Company employes are veterans of World War II according to a company survey which also showed that "disabled veterans in 99 percent of the cases have stepped back into the harness and are doing excellent jobs in their old positions or new ones." About 2½ percent of former Sun employes who returned to the company are suffering war-incurred disabilities.

Rangely Yield Cut

Rangely field, Colorado, production was cut to 200 barrels per day, according to the per-well ratio basis established by the purchasing company, Standard Oil Company of Indiana, which has the only pipe line outlet from the field. Field production will remain at around 26,000 barrels daily from the Weber sand. There are now approximately 120 producing wells from this sand, and 50 rigs are now drilling to this sand in the field.

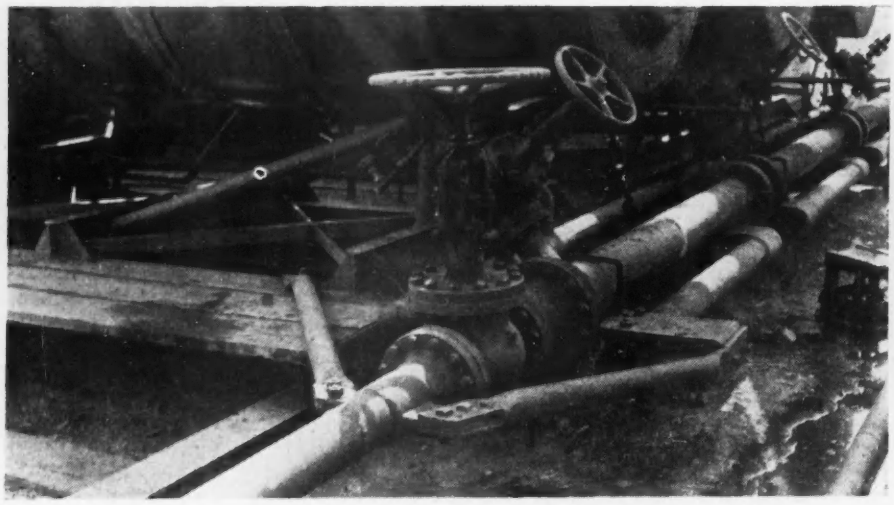
Decline Curve Extrapolation

■ CONTINUED FROM PAGE 57

plete quantitative analysis of the performance of a well or group of wells. They also permit to gage quantitatively reserve calculation of settled production practice by computing the coefficients of the new performance equation. When speed is not a factor, mathematical methods of decline curve analysis will prove a most useful and accurate tool to the reservoir engineer in predicting certain type of performances and in reserve calculation of settled production as well as in secondary recovery operations.

DRILLING HINTS

Braces Snub Header Vibrations



$5.00 is paid for each illustrated acceptable contribution. Mail to The Editor, THE OIL WEEKLY, P. O. Box 2608, Houston 1, Texas

STEAM LINES

In order to relieve the boiler steam header fittings of excessive strain caused by alternating expansion and contraction of steam lines, one company provides a dual brace system attached to the line downstream a foot or so from the main valve at the end of the header. The two pipe braces shown are bolted to lugs welded or bolted to the line and boiler skid base, and are attached in such a way that quick removal is possible should the valve or fittings nearby have to be removed for repair or replacement. The labor expended in installing such a protective device will be offset by the savings realized in repair of steam leaks in header fittings.

PENBERTHY

"REFLEX"

WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

See Pages 2450 to 2455, Composite Catalog

PENBERTHY INJECTOR CO.

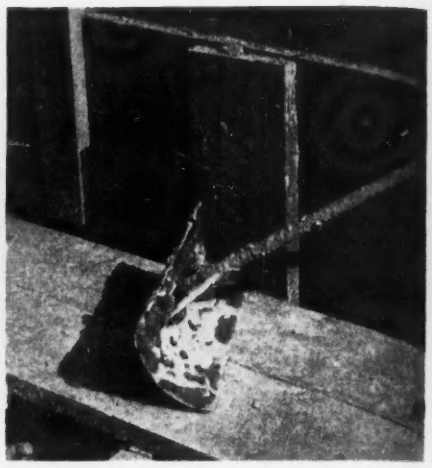
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

Shale Shaker Wash Down

SHALE SHAKERS

Prevention of the piling-up of cuttings along the lower edge of the shale shaker may be facilitated by installation of a water sprinkling line mounted across the edge of the launder as shown. The ½-inch line, perforated on the under side at intervals of two or three inches, provides a steady flow of numerous tiny streams of water which tend to dissolve or break up accumulations of caked mud or large cuttings, thus preventing the start of a congestion that would make it necessary for a man to clean it out with shovel or scraper. The small amount of water going over the side then helps to maintain a clean launder, keeping cuttings moving into the waste pit. Two valves in the system permit adjusting the flow for each shaker, so that fluctuating mud flows or the shut-down of one side will not prevent efficient operation of the other.

Mud Ditch Hoe

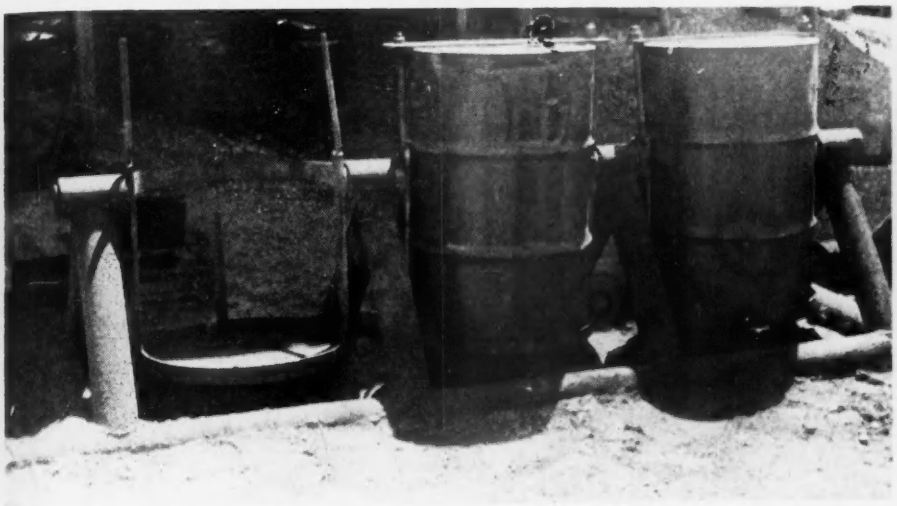


HAND TOOLS

The periodic task of cleaning out the mud ditch and clearing it of obstructions was considerably simplified by an enterprising man on one rig crew. Instead of using a shovel or common hoe as frequently is done, he constructed an improved tool made from a short quarter-section of light casing and attached it to a pipe handle of convenient length. Blade of the tool is just wide enough to clear the inner sides of the mud ditch. The handle base was welded to the hoe somewhat above center, as shown, to permit its being held deeper in the mud settlings encountered in the ditch. Short pieces of sucker rod material welded between the handle base and hoe give considerable strength to the unit, permitting it to be used in heavy work that might break an ordinary shovel handle. The fact that it can be pulled through the ditch in a single pass makes its use desirable by crew members due to the saving in time.

DRILLING HINTS

Oil Drum Rack Skid Mounted

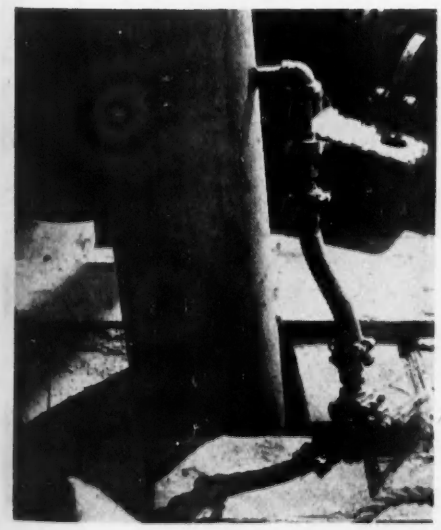


MATERIAL HANDLING

Ease of handling and transporting drums of lubricating and diesel fuel oil may be facilitated by the construction of a unitized skid-mounted drum rack as shown. One drilling operator, following a trend of unitization of equipment, fabricated this rack to simplify the job of handling and transporting drums of lubricating oil and diesel fuel. Constructed primarily of discarded 4½-inch drill pipe, the framework is entirely welded. The skid base and eight braces form the body of the rack, with a short section of pipe welded horizontally at the intersection of each pair of supporting members to act as a bearing for the drum cradle. Bottom of the cradle is of ¼-inch plate steel cut to snugly fit the bottom of a standard 42-gallon barrel. A lip has been welded around the periphery of this bottom to prevent the drums from sliding off the rack when in use. Two upright members of ¾-inch sucker rod are welded to either side of the bottom section, with the upper six inches threaded to take a heavy nut. About midway up on these uprights are welded two supporting lugs which fit inside the bearing members made of pipe. A back-strap, also of plate steel, is attached to this swinging cradle to further secure the drums in place. A piece of bar steel, long enough to span one drum, and with holes bored in each end, completes the cradle.

Drums of lubricating oil or diesel fuel are placed in the cradles and the cross bracket is bolted in place to form a firm grip on the drum. In this manner, it is not too difficult for one man to withdraw as much of the drum's contents as needed without spilling oil over the ground. Though three cradles are shown, one, two or four can be made as described above.

Kelly Cleaning Device



KELLY CARE

Each time the kelly is lowered into the rat-hole it usually becomes at least partially covered with muddy or oily fluid, which makes it disagreeable to handle when it is made up on a new joint of drill pipe and lowered into the rotary bushing. Further, a muddy kelly makes difficult the marking of the stem in checking progress of drilling. One company, in providing a means of quickly cleaning off the kelly without recourse to the water hose and consequent messy, slippery floor, welded a water line fitting into the side of the kelly a foot or two above the level of the derrick floor. A short length of flexible rubber hose is used in the connection to absorb vibrations and movements of the rat-hole pipe, and a small plug-type valve is placed in the line at the point where the line emerges from beneath the rig floor.

"It won't be long now, boss!

"The boys are really washing her since we ran that Baker Casing Scraper and smoothed up the inside of the casing. We haven't even nicked a swab rubber, which tells me the casing must really be clean!"

He is right, for a

BAKER CASING SCRAPER

not only removes burrs left from gun perforating but also scrapes off hardened cement, mud, and even mill scale. It is reasonable to rent, and your crews can run it easily.

Call any BAKER office for Service

LOAD BINDERS

PAT. PENDING
SMOOTH HANDLE STEEL LOAD BINDER
MIDGET (1 swivel) ¼" chain
DELTA (1 swivel) ⅜" chain
DIXIE (2 swivels) ½" chain
MALLEABLE IRON LOAD BINDER Heat Treated
LONE STAR No. 1—14 lbs. (2 swivels ½" and ⅝" chain
LONE STAR No. 2—16½ lbs. (2 swivels) ½" and ⅝" chain
DROP FORGED LOAD BINDER Heat Treated
No. 1—10 lbs. (2 swivels) ⅜" and ½" chain
No. 2—17½ lbs. (2 swivels) ½" and ⅝" chain

STEEL CONSTRUCTION WIRE STRETCHERS

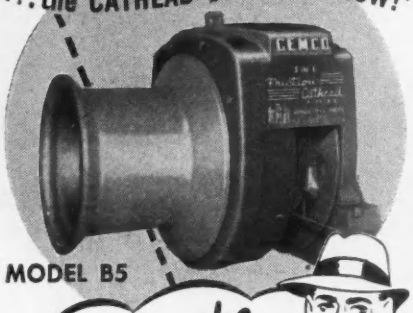
No. 3—3	Pulleys,	plain bearings,	⅜" rope
No. 33—3	Pulleys,	roller bearings,	⅜" rope
No. 4—4	Pulleys,	plain bearings,	½" rope
No. 44—4	Pulleys,	roller bearings,	½" rope
No. 88—4	Pulleys,	roller bearings,	½" rope

DURBIN-DURCO

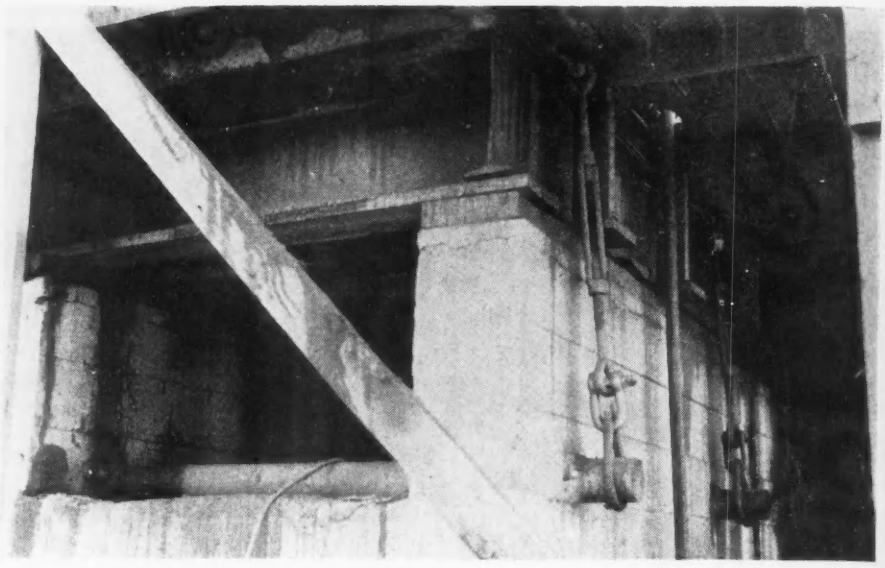
Manufacturers of Certified Specialties

Drop Forged and Malleable Iron

6611 OLIVE ST. ROAD — ST. LOUIS 5, MO.

GEMCO
FRICTION TYPE CATHEAD
"... the CATHEAD OF TOMORROW!"

MODEL B5
"... here's the SIMPLEST, MOST MODERN SPINNING and BREAKOUT COMBINATION ever offered!"
FRICTION-TYPE CLUTCH
Internal expanding — large friction area. No toggles, no thrust bearings. No adjustments required. Has ample power to make or break toughest joints.
SHORT AND COMPACT
Length, including Spool, standard Adapter, only 23 in. With extended Adapter, may be mounted any distance from shaft bearing.
OPTIONAL CONTROLS
Mechanical, hydraulic or air. Fully interchangeable and need not be disturbed when removing or replacing Cathead Unit.
CHEMICALLY COOLED SPOOL
16 IN. DIAMETER
Can be furnished instead of the 12-in. or 16-in. regular Spool at small additional cost.
MOUNTS ON EITHER SIDE OF DRAWWORKS
The only single Unit available that operates equally well on either side of Drawworks — as Spinner, Breakout or as Make-and-Break combination.
SMOOTH • EFFICIENT • ECONOMICAL
Consult your Drawworks Manufacturer, Supply Store or Write Us Direct.
GEMCO OIL TOOLS, INC.
4417 OLEATHA AVE., ST. LOUIS 16, MO.

Anchors Provide Engine Tie-Downs



ENGINE MOUNTING

In rough terrain the problem of mounting drilling engine and derrick supports is considerably more complicated than routine level-ground installations, and usually involves pouring of heavy concrete bases in order to elevate equipment to the derrick floor level.. A practical and economical means of anchoring the drilling engine which is mounted atop one such concrete base is shown. The outer ends of several horizontal transverse pipe sections are employed as anchor points for the tie-down turnbuckles. Laid across the the middle part of the form when concrete is being poured, the pipes are buried under the overlying parallel piers, and provide a convenient means of quickly attaching turnbuckles.

A projection on the bottom side of each extending tie-down prevents the steel loop from working in toward the concrete wall, thus permitting the turnbuckle to be directed out and away from it at a slight angle. Providing cushion and a better friction surface for the skid-based drilling machinery are two-inch planks laid along the top of each of the concrete pedestal legs. Additional boards, of one-inch thickness, are then laid across the top at right angles to the planks.

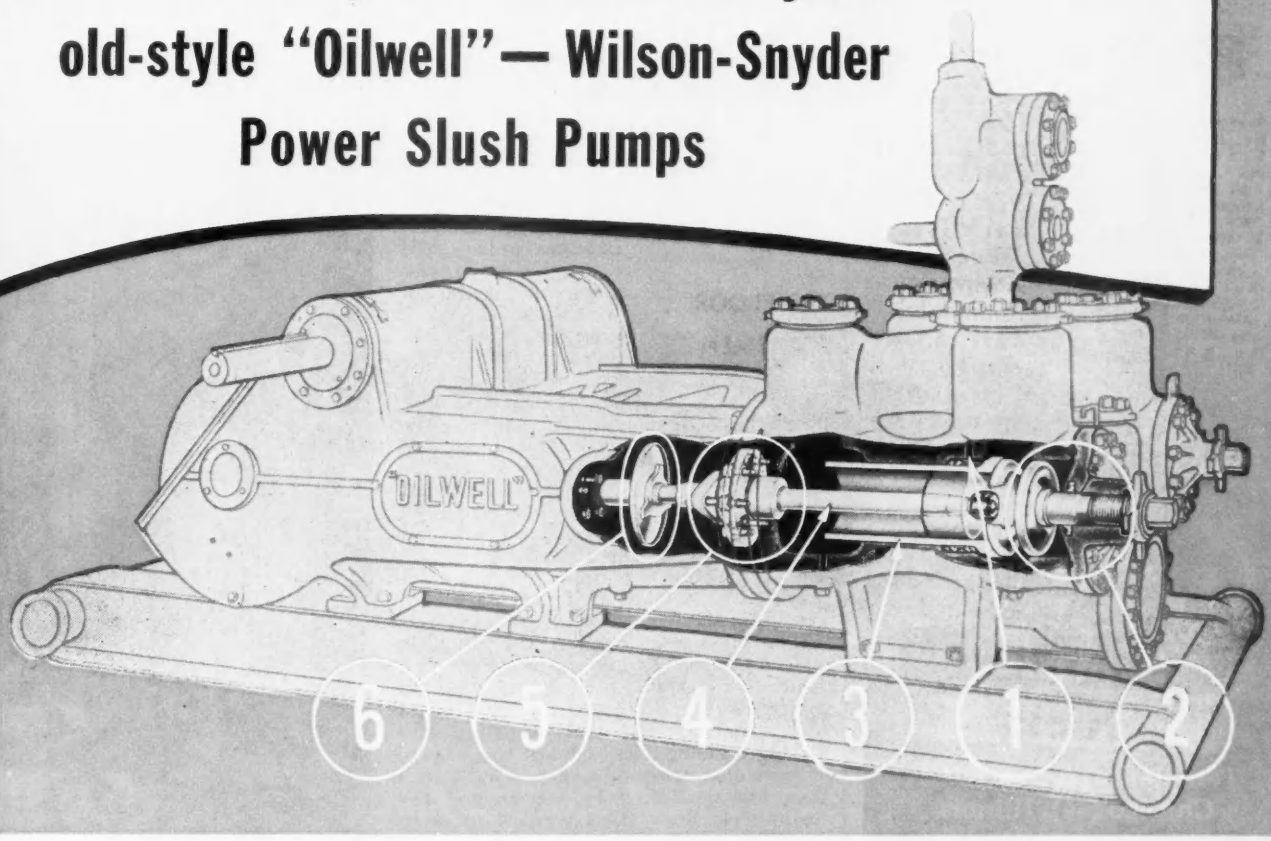
Ready-Built Light Sockets Speed Rigging Up

RIG LIGHTING

One of the most useful aids to night work on the portable drilling rig of one drilling company consists of a movable light standard that can be stationed at almost any desired position along the edge of the unitized walkway or casing rack. Provision is made for attaching a socket made of a salvaged pipe nipple to the outer edge of the steel T-shaped supports on top of which the planking is laid. Into the socket is placed the light standard, the latter being a ten-foot length of two-inch pipe having a collar and lug at the top and bottom, a short conduit fixture being tapped into the side of the collar. The light fixture may be turned to any desired angle, and by rotating the upright support on its vertical axis, any area on or beside the rack may be illuminated.

Also of great value to this installation is the provision made for an extension line which can be plugged into a convenient fitting beside the lamp conduit line.

It's so easy to *Modernize* your old-style "Oilwell"—Wilson-Snyder Power Slush Pumps



"Change-Over Assemblies" are now available which enable you to convert early-model "Oilwell"—Wilson-Snyder Power Slush Pumps and equip them with the following ultra-modern features:

1. *Tell-Tale Liner Packing* gives immediate indication of mud leakage past the liner packing and enables the operator to make necessary adjustments before cut-out cylinders occur.
2. *Type "HD" Heavy Duty Liner Spacer Assembly* permits instant stoppage of packing leaks by the easy external adjustment of a single large-diameter, grease-lubricated adjusting screw which extends through the cylinder head and is held in place by a hammer-blow lock nut. This adjustment can be made without shutting down the pump.
3. *DI-HARD Fluid Cylinder Liner* has an exceptionally hard, abrasion-resisting bore honed to a mirror finish which reduces liner wear and holds piston replacements to a minimum.
4. *HI-HARD Piston Rod* with A.P.I. Taper is fully heat-treated for maximum strength, then surface hardened, ground and polished to prolong rod and packing life.
5. *Extra Deep Stuffing Box Assembly* reduces the frequency of repacking jobs by increasing the number of packing rings in the assembly and permitting pump operation with less work for each packing ring.
6. *Mud-Baffle Assembly* for installation in the cradle section, prevents mud and water from traveling along the rod to enter the power end.

It will pay you to recondition your old-model "Oilwell"—Wilson-Snyder Power Slush Pumps. Under the direction of an authorized field-service engineer the very latest lubrication and fluid-end refinements can be installed to give old pumps the same ease of maintenance and long trouble-free service achieved by late models.

Design refinements are always engineered to fit old "Oilwell"—Wilson-Snyder pumps, as well as the latest models. That is why so many operators are buying all their pumps from "Oilwell".

Check up — *at your Nearest "Oilwell" Store* — TODAY

OIL WELL SUPPLY COMPANY

Branches Serving All Oil Fields

Executive Office—Dallas, Texas
Export Division Office—
30 Rockefeller Plaza
New York 20, N. Y.

Division Offices—Columbus, Ohio
Dallas, Texas . . . Denver, Colorado
Houston, Texas . . . Tulsa, Oklahoma
Los Angeles, California

UNITED STATES STEEL

OIL WELL SUPPLY COMPANY · USS · "OILWELL" · UNITED STATES STEEL

"OILWELL"

Rugged Rig Skidder!

Simplex No. 2029. Single Acting Ratchet Lowering Jack. Lifts 20 tons full 18". Minimum height 28¼". Minimum toe lifting height 2½".

The No. 2029 20-ton capacity Simplex Jack is a natural for moving rigs from one location to another. Provides greater speed, safety and lifting range. Used in pairs, in lieu of cranes, for loading and unloading heavy equipment. Order from your supply house today.

Simplex
LEVER SCREW - HYDRAULIC
Jacks

Templeton, Kenly & Co.
Chicago (44), Illinois
Better, Safer Jacks Since 1899

"THE EXAMINATION OF FRAGMENTAL ROCKS"

by

Frederick G. Tickell

Professor of Petroleum Engineering at Stanford University

An outline of the physical properties of fragmental aggregates and of their mineral constituents, this book is a laboratory manual and guide for students, geologists, petroleum engineers, chemical engineers and microscopists —in fact for all those interested in a practical treatment either of identity or of size and shape relationships of fragmental rocks.

Fabrikoid Covering — 154 Pages

PRICE $4.00

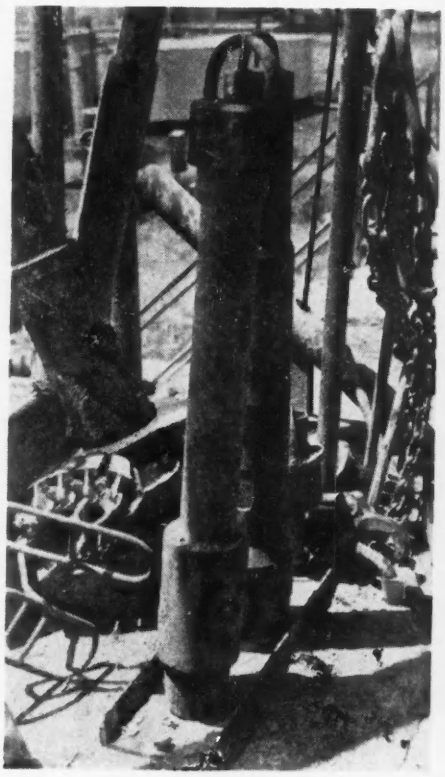
Send orders to

THE GULF PUBLISHING CO.

P. O. Box 2608 Houston, Texas

Subs Racked On Portable Steel Pins

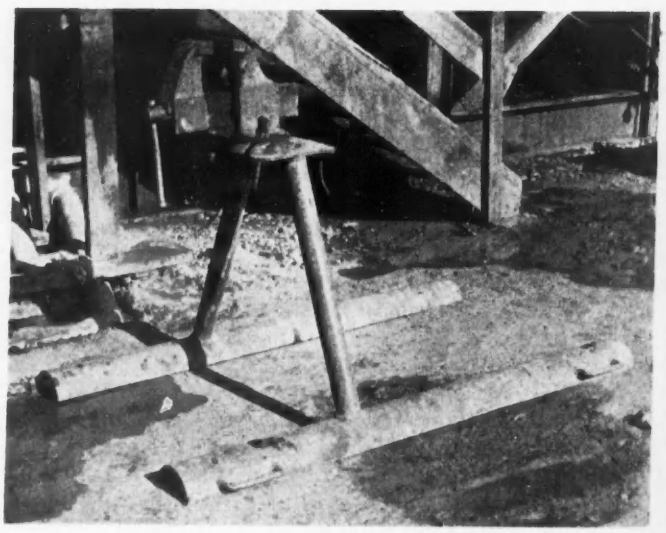
RIG FLOOR EQUIPMENT



A small device that saves considerable time on the drilling rig floor is a steel pin-studded plate which can be anchored to any point on the floor. It consists of a length of ten-inch rig channel material laid channel side up, and along the center of which is welded a number of steel sucker-rod material pins over which may be placed drill pipe subs, pipe-type fittings and other tools. The channel may be spiked or lag-screwed to the floor. Several such units may be spotted around the edge of the floor at points where a particular type of tool is most likely to be used and where it is convenient to use a cat line or sand line to pick up the tools. The units are light, easy to take up if necessary, and are immediately ready, once the rig is set up on a new location, to help keep such tools and fittings neatly sorted and ready for instant use. In addition to giving the rig floor a neat and efficient appearance, arrangements of lifting subs in this manner also reduces the hazard of crewmen tripping over such tools if they are permitted to lay around the drilling rig floor. This method of racking lifting subs and other such devices will also lengthen their life by protecting the threads while such tools are not in use.

Simple Vise Base Made Of Salvaged Material

TOOLS



One of the handiest pieces of equipment around the rig is the portable vise and support devised by the superintendent of one drilling department. It consists only of a pair of pipe legs surmounted by a flat plate on which the heavy vise is mounted. Construction of the legs provides the principal reason for its ease in handling. The two pipe legs are welded to the convex surface of two partial-sections of eight-inch casing which have been split lengthwise as shown. Placed on any type of ground, these broad bases easily can be adjusted to a level position, soft plowed ground being as easily worked on as hard ground. The bases offer no obstruction to walking and handling of equipment, yet are sturdy and light in comparison to the heavy work that can be done with the vise. Handles on the outer edges of the pipe bases permit lifting or dragging the unit to any desired part of the rig location.

The base plate of the vise is so constructed that the vise may be rotated about its axis to facilitate its use in any direction. A steel pin ¾-inch in diameter is placed in holes bored in the base plate at various positions to secure the vise in any one of several positions. If need be, the vise may be removed for transporting.

NEW EQUIPMENT LITERATURE

For additional information, use mailing card inserted opposite this page

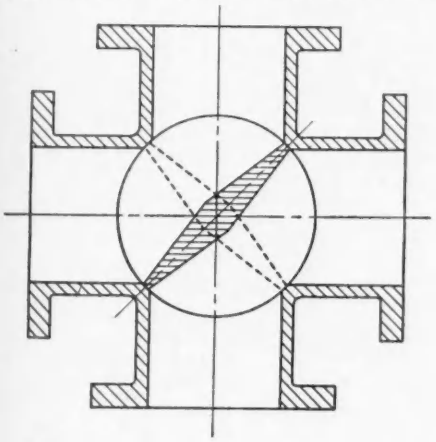
1—Journal Jacks

The Buda Company has announced the addition of 50-ton hydraulic journal jacks to their present line. The hydraulic jacks have two distinct speeds — a fast speed for quickly raising light or medium-heavy loads, and normal or standard speed for raising capacity loads. Operation in raising loads is by easy pumping action. Lowering of loads is regulated by a simple control valve, putting the loads under complete control of the operator. Loads may be held indefinitely at any height. Models 50-B-2 and 50-B-26 hydraulic jacks are of 50-ton capacity designed especially for general high-lifting jobs. They are claimed to be used widely in railroad repair shops, for bridge work and for extremely heavy industrial lifting. Model 50-B-2 has a closed height of 12 inches, a raised height of 19 inches, and weighs 120 pounds. The heavier model has a closed height of 26 inches and lift of 20 inches. It weighs 200 pounds.

(Check item 1 on postcard for more information.)

2—Transfer Valve

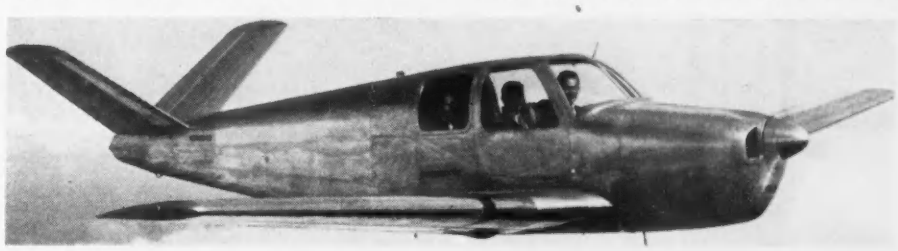
A new-type, 125-pound, single-vane, four-way transfer valve has been introduced by R-S Products Corporation. It is designed to handle chemicals, oil, paper pulp, sewage, water, abrasive mixtures and other materials from one line to another. It can be manually or automatically operated. It is available for a wide range of pressures together with sub-zero and elevated temperatures. Equipped with adjustable stop screws and indicator to determine vane position, this valve can be fabricated from all types of metals in sizes from four to 72 inches. For applications which give rise to hard wear and severe stresses, the valve is constructed of R-S "A" metal.



(Check item 2 on postcard for more information.)

3—Monoplane

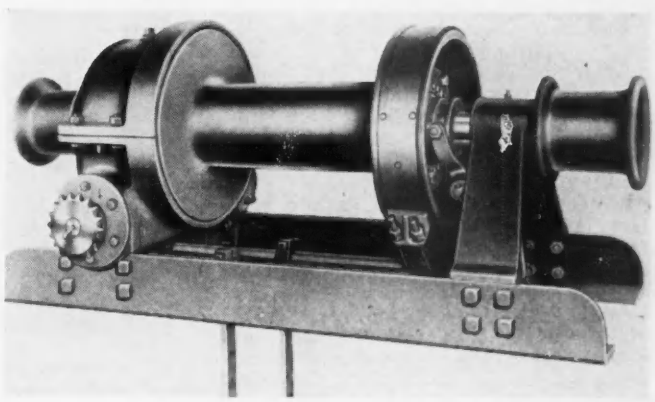
"Bonanza" is the name given the new four-place, all-metal, low-wing, model 35 monoplane recently introduced by Beech Aircraft Corporation. Rated at 115 horsepower, the plane has a cruising speed of 150 miles per hour. The Bonanza is equipped with a complete set of flight instruments for night and day flying; radio receiver, transmitter, marker beacon receiver, homing loop, and automatic antenna reel; cabin heating and ventilating systems, with windshield deicers; soundproofing; continuously variable controllable pitch propeller; navigation, cabin, instrument, and landing lights; four adjustable sunshades, four individual ash trays, cigarette lighter. Manufacturers claim the direct operating cost of the plane when used approximately 100 hours per month is less than 1½ cents per passenger mile, counting three passengers only and not including the pilot.



(Check item 3 on postcard for more information.)

4—Truck Winches

A new line of truck winches was recently announced by the Lufkin Foundry & Machine Company. Model 15 has a line pull of 15,000 pounds, while model 30 has a line pull of 30,000 pounds. These new winches have been designed to provide a sufficient factor of safety to insure reliable service and long life. Oversize worm gears of special heat treated gear bronze are used and are "run in" with the heat treated alloy steel worm before shipment. A patented drum clutch is provided with tapered tooth design which the manufacturers claim is easier to engage and disengage, and will not slip. The greater the load, the tighter the clutch will hold. Both models are so constructed that they may be mounted on all types of truck beds. The driving chain gear operates from a power takeoff on the transmission. Both winch models are equipped with two catheads, one at each end of the drum shaft, for utility purposes where manila hemp rope is used.



(Check item 4 on postcard for more information.)

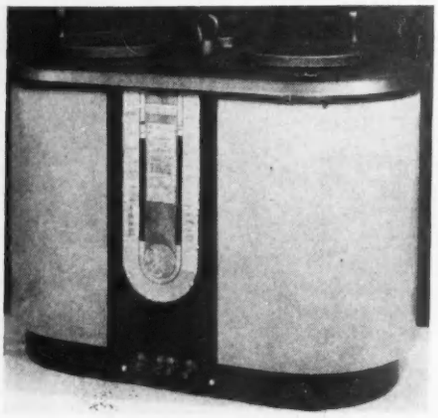
5—Hand Rotary Pumps

Standard Machine Works is producing two new model hand rotary pumps. They are identical in design and capacity except that Model G12HB has a swivel spout for use as a barrel pump, while Model G12HR has a hose attachment for use as a refueling pump. Weighing about 18 pounds, height of the pump is 8¼ inches without either spout. Handle radius is 4½ inches. These models are balanced rotary pumps operating on a cam principle with a capacity of 12 gallons per minute by hand operation. The body is of Meeanite cast iron, rotors of cast steel, vanes of steel, shaft of steel and handle of cast iron.

(Check item 5 on postcard for more information.)

6—Arc Welder

A new twin-unit, out door a-c arc welder in a single enclosure has been announced by the Electric Welding Division of General Electric Company. Each of the two circuits in the welder



can be used simultaneously and independently with electrodes up to 3/16-inch in diameter, or combined into one circuit for heavy welding with ⅜-inch electrodes. The units have a current range of from 90 to 270 amperes, when used singly and from 180 to 540 amperes when operated in parallel.

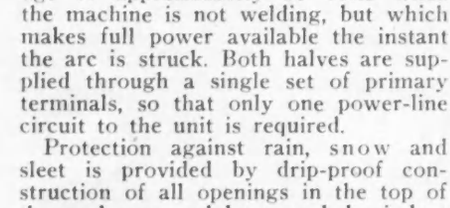
Both welders are equipped with control which reduces the open circuit voltage to approximately 30 volts when the machine is not welding, but which makes full power available the instant the arc is struck. Both halves are supplied through a single set of primary terminals, so that only one power-line circuit to the unit is required.

Protection against rain, snow and sleet is provided by drip-proof construction of all openings in the top of the enclosure and by a sealed window over the current indicators. Ventilating openings at top and bottom are of such proportions that they shed water and keep the ventilating air velocity low.

(Check item 6 on postcard for more information.)

7—Threading, Tapping Tool

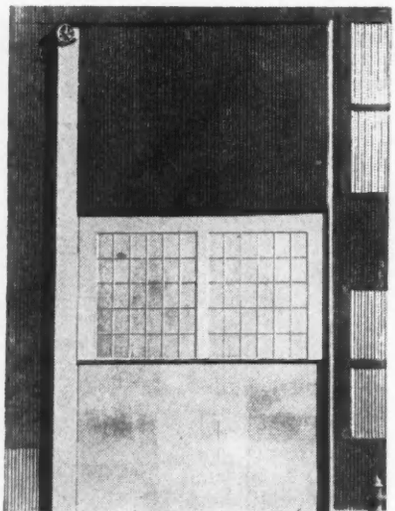
A new hand tool announced by The Thread Miller Corporation has been designed to permit threading and tapping at high speeds in a lathe. Known as the Grip-Slide Threading and Tapping Tool, it can be used for cutting either right- or left-hand threads. Sliding movement of the die or tap holder takes place on a hardened and ground guide bar concentrically true with the tapered shank that fits into the tailstock spindle. The die or tap holder also is a hardened and ground piece having the bore for the guide bar concentric with the recess in which the die or tap is held. Thus the tap or die is in perfect alignment with the work held in the chuck of the lathe. The die or tap holder is a precision sliding fit on the guide bar which is marked at 4-inch intervals for accurate duplication of thread length on parts. Two sizes are furnished. The Regular size is for use in bench and small engine lathes, while the Giant size is designed for use in larger lathes.



(Check item 7 on postcard for more information.)

8—Door Structure

A New, complete door structure, entirely prefabricated to meet individual specifications and requirements, is being manufactured by the Fleming Steel Company. It is installed on the outside

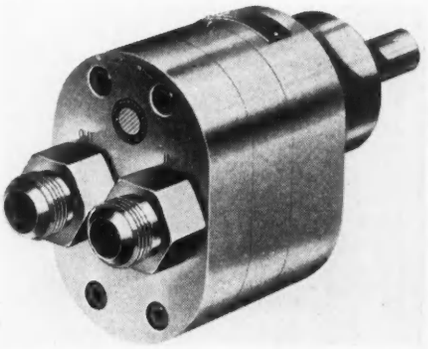


wall of buildings to eliminate interference with overhead pipes, wires or equipment inside the building. The door may be made of two, three, or four sections. The sections are synchronized through gears to open or close fully at the same instant. It has been applied with success to buildings previously lacking suitable entrances for trucks and railroad cars. In operation, counterweighted cables make the door easy to open by hand pulley either from inside or outside building, or it may be electrically operated from one or more switch stations. This type door has been designed, the manufacturer asserts, to minimize maintenance.

(Check item 8 on postcard for more information.)

9—Hydraulic Pump

The McIntyre Company announces Series 700 hydraulic pump, designed for high pressure application for material handling equipment, machine tools, oil well sampling, power transmission, proporportioning equipment, and low capacity pressure circulation and delivery functions. This direct drive spur gear pump is a small six-pound unit which is claimed to operate with a volumetric efficiency in excess of 90 percent and a mechanical efficiency in exces of 80 percent. Four models displace from 0.4 gallons per minute to 9.6 gallons per minute at speeds ranging up to 1750

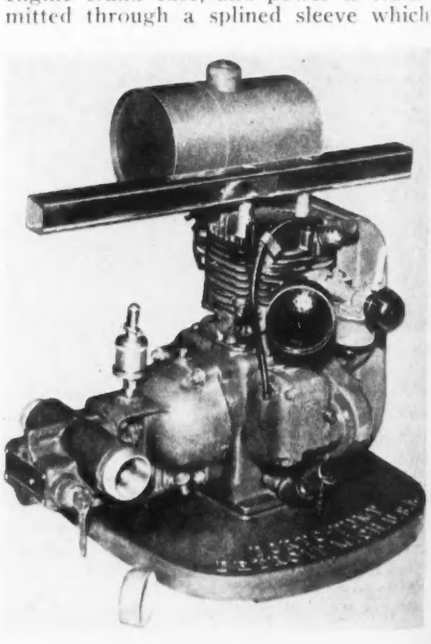


revolutions per minute against working pressures up to 1000 pounds per square inch. Power requirements vary between fractional to 6½ horsepower. The pump body is of aluminum with nitrided nitralloy gears. Positive sealing is accomplished with linear packing double "U" cup seals. Standard models are designed for direct motor application, but pumps can be furnished for flange, belt, spline and other drives.

(Check item 9 on postcard for more information.)

10—Utility Pump

A new, high-pressure utility pump is being manufactured by Porto-Pump, Inc. On accredited flow-meter tests, the pump is said to have delivered 43 gallons per minute at 100 pounds per square inch discharge pressure; over 40 gallons per minute at 120 pounds per square inch discharge pressure and has a suction lift of 31 feet. The self-contained power source is a single-cylinder, four-cycle, air-cooled engine which is rated at five horsepower. Main bearings are of the taper-roller type, assuring smooth operation and long life. The pump is mounted directly onto the engine crank case, and power is transmitted through a splined sleeve which



acts as a self-aligning coupling. Rubber impellers virtually eliminate abrasion by dirt particles, according to the Manufacturer. These impellers expand longitudinally under pressure, preventing water loss by leakage due to end play. The transmission gears are separate and operate in an oil bath. The engine crank case is also filled with oil to eliminate adding oil to the gasoline. A by-pass valve mounted on the outer end of the pump facilitates starting the pump against a head of water. It permits the circulation of water within the pump to lower back pressures.

(Check item 10 on postcard for more information.)

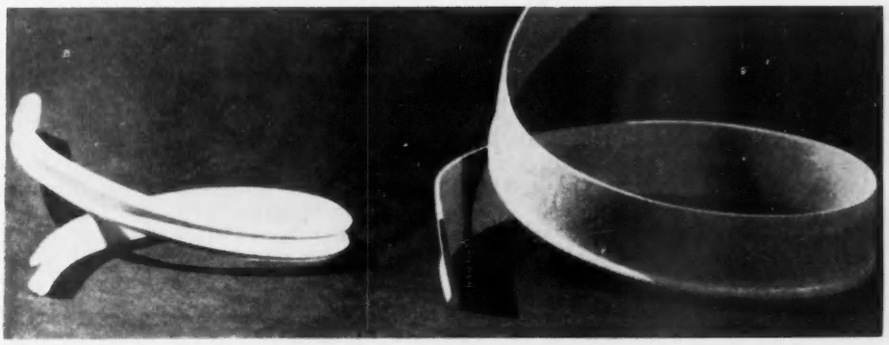
11—Gauges

Vard Incorporated has announced the addition of certified standard API gauges to its line of thread and cylindrical gauges. These gauges are said to be manufactured to American Gauge Design standards and are scientifically heat treated and sub-zero stabilized. The API tool joint, cable tool joint, sucker rod, standard tubing, line pipe and casing gauges are all made of fine tool steel.

(Check item 11 on postcard for more information.)

12—Silicone Rubber

Silicone rubber is the youngest member of the silicone family developed through General Electric chemical research. Outstanding because of its heat resisting qualities and flexibility at both high and low temperatures, the new material is said to outlast ordinary rubber or rubber-asbestos compound. Tests reveal that the hardness of silicone rubber increases slightly after a year's heating at 300° F., but retains considerable flexibility. Another feature claimed is that it will not adhere to metal or any other material in spite of its continued use at high temperatures and under oxidizing conditions. This will eliminate the possibility of any vulcanizing action to metal when submitted to high temperatures. The chemical inertness of the silicone rubber is further evidenced by its non-gassing characteristics under high vacuum at elevated temperatures.



(Check item 12 on postcard for more information.)

Literature

13—Instrumentation

Brown Instrument Company has released the second quarterly issue of "Instrumentation." Volume 2, No. 2, contains 32 pages of technical and pictorial information in the field of instruments and meters. It includes ten articles written by instrument specialists concerning the application, design and principles involved in the instrumentation and controls. Of particular interest is the article, "The Measurement and Control of pH," by D. M. Considine, who discusses the many phases of pH control and measurement. He dwells on the various means of such metering and goes somewhat into the chemistry of the subject. This magazine is of standard size and is fully illustrated.

(Check item 13 on postcard for more information.)

14—Drilling Mud

An eight-page, two-color standard-size booklet has been released by Oil Base, Incorporated, and is intended as a valuable source of information and aid to drilling superintendents, engineers, and drilling contractors throughout the oil producing areas. Much of the material in this booklet will answer queries on the features of Black Magic drilling mud, covering light, medium and heavy weights, and the use of each. Results through exhaustive tests, covering a period of years of drilling, are legibly charted on easy-to-read, two-color graph charts. There are also full explanations about Black Magic, its use, mixing, gel properties, temperatures, make-up weights, regeneration, cementing, advantages and characteristics.

(Check item 14 on postcard for more information.)

15—Sucker Rods, Couplings

The D & B Division of Emsco Derrick & Equipment Company has issued Bulletin 601-A, a multi-colored, standard-sized, 24-page pamphlet devoted to the D & B sucker rods and couplings. Chemical analysis, physical properties, sizes and weights of the various sucker rods are listed. A section shows the manufacturing process for sucker rods, couplings and rod wrenches.

Numerous illustrations are included to give a definite understanding of the procedures involved. Metallurgy research and testing are explained as important parts of the development of these sucker rods and associated equipment. As an aid to field engineers, a table and sample calculations show how to make computation of sucker rod stresses.

(Check item 15 on postcard for more information.)

16—Drilling Equipment

A two-color, 20-page catalog describing Wagner-Morehouse, Inc.'s line of streamline oil well drilling and servicing equipment has been published. Portable rotary drilling units are generously illustrated and described in detail. A comprehensive list of specifications for each type is given. Included is a section on portable mud pumping units mounted on heavy-duty trailers. Wagner-Morehouse well servicing hoists are illustrated and actual field applications are shown and described.

(Check item 16 on postcard for more information.)

17—Belting

Designed to aid all industrial plants and maintenance men in the selection of equipment for the job, a new belting catalog has been published by Hewitt Rubber Division of Hewitt-Robins, Inc. Information in the two-color loose leaf booklet includes specifications on the company's wide line of conveyor, transmission and elevator belting sold under the brand names of Monarch, Ajax and Conservo. Maintenance suggestions advise how to prolong the life of belts and avoid costly shutdowns. Many uses of belts are illustrated. Belt constructions are shown by sectional drawings. The catalog is written in simple, non-technical terms.

(Check item 17 on postcard for more information.)

18—Plug Valves

A bulletin published by the American Car and Foundry Company describes the company's line of full pipe-area lubricated plug valves. Eight pages in length, the bulletin explains the advantages and applications of the full pipe-area port opening and how it reduces turbulence in fluid flow. A complete list of plug valves is given along with specifications for each type. A section of the publication pertains to the company's venturi type lubricated plug valves, which section also includes specifications.

(Check item 18 on postcard for more information.)

19—Packings

A 64-page catalog has been issued by Asbestos Textile & Packing Division, Raybestos-Manhattan, Inc. Printed in two colors, the catalog contains a short history of the Raybestos-Manhattan organization including illustrations of their plants. A complete description with illustrations is included of all the various styles and types of mechanical packings in the expanded R/M line, together with five pages of charts showing the type of service for which each style of packing is recommended. The catalog is said to be the most complete reference on packings ever issued by Raybestos-Manhattan.

(Check item 19 on postcard for more information.)

Runs to Stills Hit New High for Year; Gasoline, Fuel Oil Output Increased

Crude runs to stills in the week ending August 31 rose to a new high for the year and resulted in increased output of gasoline and fuel oil. As a result gasoline stocks were upped considerably and holdings of the light and heavy burning oils continued seasonal increases. This report of stocks and operations was made by the API.

U. S. crude production of 4,833,000 barrels daily was 3000 a day less than in the previous week and 43,000 a day less than the output of 4,876,000 daily in the comparable period of last year, when production was dropping from wartime levels.

Crude runs to U. S. refinery stills averaged 4,911,000 barrels daily during the week. This was 45,000 a day more than the preceding week and 273,000 a day or 5.9 percent more than the runs of the like week of last year. These runs hit a new high level for this year and exceeded the week's domestic crude production by 78,000 barrels per day.

Refinable crude oil stocks totaled 225,672,000 barrels on August 24, as reported by the Bureau of Mines. They had increased 89,000 barrels during the preceding seven days and were then 13,859,000 barrels or 6.5 percent above the 211,813,000 barrel level at which crude stocks stood one year before.

Gasoline production, including natural blends at the refineries, totaled 15,014,000 barrels for the week of August 31, an increase of 375,000 barrels over that of the previous week, but 166,000 barrels or 1.1 percent less than the output of the like week of last year. Finished and unfinished gasoline stocks were raised 966,000 barrels during the week and stood at 87,217,000 barrels on August 31. These stocks were 3,214,000 barrels or 3.8 percent higher than those reported a year ago.

Distillate fuel oil production of 5,630,000 barrels during the week was 19,000 barrels less than the output of the week before, but was 780,000 barrels or 16.1 percent over the production of the comparable week of last year when 4,850,000 barrels were produced. Distillate stocks rose to 53,134,000 barrels after having gained 1,729,000 barrels during the week. These stocks exceed those on hand one year ago by 11,889,000 barrels or 28.8 percent.

Residual fuel oil output amounted to 8,539,000 barrels for the week of August 31, an increase of 413,000 barrels over the production of the previous week and 41,000 barrels or ½ of one percent over the output of the like period of 1945. Stocks of this heavy fuel increased 1,112,000 barrels and stood at 53,173,000 barrels at the end of the week, which is 6,125,000 barrels or 13 percent more than was being held a year previously.

Trends of Operations and Changes in Stocks

Figures on crude stocks are from Bureau of Mines weekly reports; all others from American Petroleum Institute weekly reports, which are estimates on Bureau of Mines basis.

(All figures in thousands of barrels—add 000)

HIGHS AND LOWS OF RECENT YEARS

ITEM	Crude Oil Prod.		Runs to Stills		Crude Stocks		Gasoline Stocks		Gasoil and Distillate Stocks		Residual Fuel Oil Stocks	
	Barrels Daily	Week Ended	Barrels Daily	Week Ended	Barrels	Week Ended	Barrels	Week Ended	Barrels	Week Ended	Barrels	Week Ended
Highs:												
1941	4,337	11–22	4,120	10–18	266,187	3–29	99,727	3–29	[1]54,983	11–15	102,448	1– 4
1942	4,337	2– 7	3,961	1– 3	263,208	3–28	[1]109,281	3–14	47,861	11–14	95,857	1– 8
1943	4,436	11–13	4,331	12– 4	245,752	5–29	94,159	3–20	47,187	11–27	72,881	1– 2
1944	4,762	9–30	4,798	12–30	240,992	1– 1	89,162	4– 1	48,162	10–28	64,744	10– 7
1945	4,944	7–21	[1]5,140	8–18	227,554	10–13	99,012	3–24	45,341	11–17	56,074	1– 6
1946	[1]4,961	6–15	4,911	8–31	229,430	3– 2	105,233	2–16	53,134	8–31	53,173	8–31
Lows:												
1939	[3]1,601	8–26	3,125	2–18	[2]229,127	10–12	71,152	10– 7	20,722	4–15	105,397	4– 3
1941	3,364	1–11	3,490	1–18	240,399	11–15	79,923	10– 4	28,382	4–12	90,914	7–13
1942	3,297	7– 4	3,393	5–23	231,896	12–12	75,934	12– 5	29,240	4–25	72,962	12–26
1943	3,821	1– 9	3,579	3–18	232,191	1– 9	68,182	10–16	30,732	4– 3	57,596	12–25
1944	4,357	1– 1	4,228	2–12	220,258	9– 9	76,302	1– 1	30,232	4–19	49,737	3–18
1945	3,621	10– 6	3,409	10– 6	[4]211,813	8–25	70,791	10–13	26,483	3–17	38,548	5–26
1946	4,403	3– 9	4,498	1–12	218,193	1– 5	86,251	8–24	25,131	3– 9	37,289	4– 6

TRENDS OF 1945 AND 1946

Trends in Week Ended	Crude Oil			Gasoline		Gasoil and Distillate		Residual Fuel	
	Production Daily	Runs to Stills Daily	Stocks Week End	Production Weekly	Stocks Week End	Production Weekly	Stocks Week End	Production Weekly	Stocks Week End
1945:									
January 27	4,727	4,756	221,310	14,957	88,223	4,843	33,561	9,252	51,119
February 24	4,777	4,803	219,351	15,500	95,972	4,958	28,753	9,084	46,713
March 31	4,781	4,677	223,782	14,644	98,758	4,548	26,889	9,184	41,745
April 28	4,805	4,780	223,474	14,633	94,068	4,636	28,273	9,379	39,813
May 26	4,887	4,950	222,831	15,194	89,121	4,667	29,184	9,670	38,548
June 30	4,903	4,999	220,781	15,546	86,472	4,910	32,213	9,077	40,488
July 28	4,930	4,996	218,507	16,106	86,008	4,598	36,071	9,586	42,283
August 25	4,892	4,931	[4]211,813	15,986	84,693	4,960	39,782	9,356	46,201
September 29	4,357	3,812	222,387	11,913	79,552	3,940	43,689	7,047	46,853
October 27	4,273	4,838	224,230	15,530	74,335	5,159	43,472	8,691	45,943
November 24	4,469	4,648	219,363	15,681	83,184	4,802	45,258	8,800	47,474
December 29	4,474	4,729	218,918	14,546	95,205	5,055	36,651	8,765	42,447
1946:									
January 5	4,548	4,651	218,193	14,488	98,494	5,293	35,199	8,867	42,371
January 26	4,626	4,553	220,544	13,622	101,737	5,720	29,498	8,411	39,722
February 23	4,714	4,595	226,699	13,175	104,709	5,728	25,398	7,913	39,290
March 30	4,425	4,684	224,994	13,896	104,715	5,357	28,240	8,738	37,746
April 27	4,672	4,685	224,443	14,228	99,631	5,568	30,466	9,204	39,404
May 25	4,759	4,857	222,214	14,322	95,769	5,463	32,973	8,908	43,368
June 29	4,957	4,854	223,883	14,500	92,333	5,325	37,762	8,828	46,447
July 27	4,926	4,896	223,756	14,535	88,626	5,817	44,316	8,217	49,517
August 3	4,881	4,849	224,832	14,837	86,741	5,556	45,670	8,273	50,138
August 10	4,821	4,806	224,098	14,696	87,016	5,735	48,030	8,201	51,613
August 17	4,843	4,907	225,583	15,202	87,036	5,346	48,917	8,389	51,827
August 24	4,836	4,866	225,672	14,639	86,251	5,649	51,405	8,126	52,061
August 31, 1946	**4,833**	**4,911**	.....	**15,014**	**87,217**	**5,630**	**53,134**	**8,539**	**53,173**
September 1, 1945	4,876	4,638	[5]211,813	15,180	84,003	4,850	41,245	8,498	47,048
Change:									
In week	—3	+45	+89	+375	+966	—19	+1,729	+413	+1,112
In year	—43	+273	+13,859	—166	+3,214	+780	+11,889	+41	+6,125
In year	—0.9%	+5.9%	+6.5%	—1.1%	+3.8%	+16.1%	+28.8%	+0.5%	+13.0%

[1] All time peak. [2] Lowest between January, 1922 and July 1, 1944. [3] Lowest since October, 1922 due to shut down of six Mid-Continent states. [4] Lowest since December, 1921. [5] Stocks, August 25, 1945.

Humble Production Department Personnel Changes Are Made

Changes in supervisory forces of the production Department, Humble Oil & Refining Company, have been announced.

J. V. Blacklock, assistant division chief clerk of the East Texas Division, Tyler, Texas, has been transferred to the Production Operating Department in the Houston office as policy and organization coordinator.

N. B. Robins, assistant division chief clerk of the Louisiana Division, New Orleans, and W. E. Kirkham, district chief clerk of the Talco District, Talco, Texas, have been transferred to the East Texas Division, Tyler, Texas, as acting division chief clerks.

Clark Garner, assistant district chief clerk of the Talco District, has been promoted to acting district chief clerk during Mr. Kirkham's absence.

T. M. Roper, district chief clerk of the Natchez District, Natchez, Miss., has been transferred to the Louisiana Division Office, New Orleans, as assistant division chief clerk.

E. E. Setser, assistant district chief clerk, Paradis District, Paradis, La., was transferred to the Natchez District as district chief clerk.

☆ Oklahoma

Garvin County Pool Opened; Old Papoose Pool Extended

Carter opens new oil pool in Garvin County; old Papoose pool extended south; wildcat staked west of Ponca City; West Moore field gets fourth producing zone; Shell plans deep test near Elk City; 2 good producers added to Southwest Antioch pool; Coon Creek field extended west.

Garvin County: A high-gravity oil pool has been opened by The Carter Oil Company with Burford 1, CNW NW 5-1n-1w, near Katie, and northwest of the shallow Northwest Hoover field. The well was flowing at an estimated rate of 10 barrels of 41.5-gravity oil per hour with 2 million cubic feet of gas per day from Pennsylvania sand, 6085-94 feet. A drill-stem test was taken in the zone and with packer set at 6081 feet, the tool was opened 17 minutes. The well made gas in 2 minutes and oil in 10 minutes. A total of 360 feet of clean oil was recovered in the drill pipe. Bottom hole pressure was 2800 pounds, and flow pressure, 1500 pounds. The company will test the Bromide zone before completing.

Hughes County: The old Papoose pool of northern Hughes County has been given an extension ½ mile south with a combination oil and gas well. McIntyre, Sherman and Cummings' Brooks 1, SW SW SE 9-9n-9e, was started as a Booch sand test, but the outpost found water in this zone at 2706-35 feet. The first Gilcrease showed gas at 3015-25 feet and the second Gilcrease at 3035 feet showed increased gas. With total depth 3074 feet in the top of the Cromwell formation, the well on an initial test gauged 6,647,000 cubic feet of gas and 15 barrels of oil per day at 3035 feet.

Kay County: Cities Service Oil Company will drill Henry Wilde 1, SW SE SE 26-24n-1e, on a structure west of Ponca City. The test is 2½ miles north of the Red Rock pool, drilled in last November by Deep Rock Oil Corporation. In 1925-26, Gypsy Oil Company drilled Warrior 1, in SW NW NW 36-24n-1e, to a total depth of 4690 feet in Wilcox sand. It is reported to have run high structurally, and had a show of oil in chat at 4268-70 feet, where some free oil was bailed out. About 10 years ago some surface work was done in the area and Cities Service acquired its first departmental leases. In 1942 Deep Rock seismographed the area and acquired a 1-year lease on approximately 207 acres in the southeast quarter of sect 26, and the north half of sect 35. A proposed test was never drilled, however.

Cleveland County: Production from Viola limestone, on the extreme west side of the West Moore field, has been found at Skelly Oil Company's Divis 2, SE SW NW 30-10n-3w. The company is seeking permit from the Oklahoma Corporation Commission to dually complete the well from the Viola and Wilcox sand zones. The well drilled to the Wilcox at 8795 feet, total depth, for a small producer. The Bartlesville-Burgess sand tested dry, and tests were made of the Viola at 8402 feet, which showed oil. The field was discovered in the Wilcox sand, and the Bartlesville-Burgess was later developed. More recently, the Hunton lime proved productive in several spotted locations. Most Wilcox producers in the field are now exhausted.

Beckham County: Shell Oil Company has staked a 12,500-foot wildcat south of Elk City. The test, the Walters 1, CNE SW 14-10n-21w, is about 3 miles northwest of the deepest hole ever drilled in Oklahoma—Continental Oil Company's Proctor 1, CNW 28-10n-20w, in Washita County. The Proctor was drilled to 14,582 feet, stuck tools 25 feet off bottom and was abandoned after several zones were tested. Considearble royalty has been purchased through the block, extending across the Beckham County line into Washita County.

Antioch Area: Anderson-Prichard Oil Corporation has given the Southwest Antioch pool of Garvin County 2 more good producers. They are Caudill 1-A, NW SW SW 20-3n-2w, which flowed 65 barrels of oil per hour through ½-inch choke, and Caudill 1-B, NW NW NE 30-3n-2w, which flowed 594 barrels of oil in 8 hours through ½-inch choke. The Caudill-A gas-oil ratio was 500 to 1, with total depth 6595 feet. The Caudill-B's gas-oil ratio was 400 to 1, with total depth 6580 feet.

Coon Creek Area: Robert Jordan has given the Coon Creek field of Oklahoma and Logan counties an extension ½ mile west at Weisner 1, SE SE NE 4-14n-1w. The well recently flowed 44 barrels of oil through 1-inch tubing choke.

West Edmond Daily Allowable Reduced to 40,000 Barrels

In a drastic move to conserve reservoir energy as well as casinghead gas which conservation officials claimed is being wasted in vast amounts, the Oklahoma Corporation Commission reduced the daily oil allowable in the West Edmond pool from 77,000 barrels to 40,000 barrels for September. The order is retroactive to the first of the month. The action reduced the state's overall allowable from 387,220 to 350,220 barrels.

The reduction was recommended by Walker T. Pound, chief conservation officer, who asserted that approximately

Wells Completed in United States in Week Ended September 7, 1946

Data preliminary and subject to revision. Revised and more complete data on all completions shown in monthly summary of drilling, published in second or third issue of each month. More detailed data on wildcats published in third or fourth issue of each month.

State or District	FIELD COMPLETIONS: New Wells *Oil	Gas	†Input	Dry	Total	Old Wells Deepened	WILDCAT COMPLETIONS *Oil	Gas	Dry	Total	ALL COMPLETIONS: This Week	Last Week	Cumulative: This Year	Last Year
Alabama	....	....	....	....	....	....	....	....	....	....	....	....	10	24
Arizona	....	....	....	....	....	....	....	....	....	....	....	....	1	....
Arkansas	1	....	....	1	2	....	....	....	....	....	2	4	125	130
California	26	1	....	1	28	....	1	....	6	7	35	31	1,269	1,505
Colorado	4	....	....	....	4	....	....	....	....	....	4	6	99	21
Florida	....	....	....	....	....	....	....	....	....	....	....	1	17	11
Georgia	....	....	....	....	....	....	....	....	....	....	....	....	2	6
Illinois	27	....	....	14	41	....	2	1	8	11	52	45	1,556	1,265
Indiana	6	....	....	1	7	1	....	....	1	1	9	11	344	231
Iowa	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Kansas	20	4	....	8	32	....	....	....	3	3	35	41	1,404	1,142
Kentucky	2	1	....	3	6	1	2	....	4	6	13	13	423	393
Louisiana	12	2	....	3	17	....	....	....	2	2	19	31	881	702
North Louisiana	7	2	....	2	11	....	....	....	2	2	13	15	488	262
South Louisiana	5	....	....	1	6	....	....	....	....	....	6	16	393	440
Michigan	2	3	....	3	8	....	....	....	5	5	13	21	530	526
Mississippi	....	....	....	1	1	....	....	....	1	1	2	4	148	262
Missouri	....	....	....	....	....	....	....	....	....	....	....	....	22	37
Montana	4	1	....	1	6	....	....	....	....	....	6	6	180	155
Nebraska	....	....	....	....	....	....	....	....	....	....	....	....	3	3
New Mexico	12	....	....	....	12	2	....	....	2	2	16	9	291	299
New York	15	....	10	....	25	....	....	....	....	....	25	26	825	768
North Carolina	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Ohio	8	8	....	6	22	....	....	....	....	....	22	25	814	657
Oklahoma	37	7	1	15	60	2	....	....	3	3	65	66	1,901	1,630
Oregon	....	....	....	....	....	....	....	....	....	....	....	....	2	....
Pennsylvania	28	4	15	2	49	1	....	....	....	....	50	49	2,150	2,027
Tennessee	....	....	....	....	....	....	....	....	....	....	....	....	2	3
Texas	85	6	1	30	122	1	5	1	37	43	166	166	5,599	5,021
E.Tex.Bor. Co.'s	....	1	....	....	1	....	....	....	....	....	1	7	125	65
Rest of E. Texas	5	....	....	1	6	....	....	....	2	2	8	13	374	151
North Texas	16	....	1	11	28	....	....	....	13	13	41	37	1,605	1,203
W. Central Tex.	3	1	....	9	13	1	3	....	5	8	22	16	443	332
West Texas	29	....	....	3	32	....	....	....	....	....	32	42	1,175	1,234
Tex. Panhandle	5	3	....	....	8	....	....	....	....	....	8	5	258	421
G. Coast, Upper	11	....	....	1	12	....	1	....	4	5	17	11	447	481
G. Coast, Lower	13	1	....	3	17	....	1	1	7	9	26	23	767	724
Southwest Texas	2	....	....	2	4	....	....	....	3	3	7	6	293	344
S. Central Tex.	1	....	....	....	1	....	....	....	3	3	4	6	112	66
Utah	....	....	....	....	....	....	....	....	....	....	....	....	2	....
Virginia	....	....	....	....	....	....	....	....	....	....	....	....	2	....
Washington	....	....	....	....	....	....	....	....	....	....	....	....	1	1
West Virginia	2	7	....	3	12	2	....	....	....	....	14	13	494	547
Wyoming	2	....	....	....	2	....	1	....	1	2	4	2	110	110
Total U. S.	293	44	27	92	456	10	11	2	73	86	552	570	19,211	17,478

* Includes distillate wells. † Includes salt water disposal wells.

320 million cubic feet of casinghead gas was being vented at the wells and at gasoline plants. Pound also declared that gas-oil ratios have increased steadily during the past three years and now stand at 6219 feet of gas per barrel. Producers in West Edmond offered no opposition to the order.

☆ Kansas

Ryan Pool of Rush County Has ½-Mile West Extension

Ryan pool extended ½ mile west; Sinclair gets gasser in old Skinner pool; Stanolind gives Hugoton long extension westward; prospective pool opener fails, is abandoned.

Rush County: The Ryan pool has been given an extension ½ mile west by Magnolia Petroleum Company's Tammen 1, SE SE SE 33-19s-16w. The well flowed 41 barrels of oil in 12 hours from total depth of 3758 feet and operators will deepen and acidize. Lansing was topped at 3423 feet and the Arbuckle lime at 3732 feet, where a show of 2 million cubic feet of gas was found.

Barber County: Sinclair Prairie Oil Company has a gas well in the old Skinner pool at Oldfather 2, NE SE SE 7-31s-14w. The well made 2½ million cubic feet of gas per day from the Viola lime, topped at 4331 feet. The company completed Oldfather 1, CSE½ 7-31s-14w, in March for 3000 barrels of oil per day from the Simpson sand, 4422-95 feet, thus opening a new horizon for the pool. Other wells in the pool produce from Viola and Arbuckle limes.

Kearny County: The Hugoton gas area has been given an extension 7 miles westward by Stanolind Oil & Gas Company's Glazer 1, center of 13-26s-38w. The well was completed for a flow of 2,376,000 cubic feet of gas per day from Permian sand, 2432-2640 feet, with total depth 2640 feet. Stanolind has been active in Kearny and other Western Kansas counties and has acquired over 200,000 acres of leases on fringes of Hugoton.

Rooks County: Cities Service Oil Company has abandoned Milner 1, SW SW NE 17-8-18w, 2 miles northwest of the Krider pool. The well at first showed signs of being a pool opener when oil was recovered in the Lansing lime. Water encroachment prevented the well from being brought into production, however. Total depth was 3457 feet in the Arbuckle lime.

Appalachian Basin and New Mexico Charts Ready

Asphaltic residues found in the rocks along the front of the Sangre de Cristo Mountains in New Mexico, indicate the former presence of oil at least locally in that region, some of which may have been retained beneath the surface in favorable traps, Director William E. Wrather of the U. S. Geological Survey has reported in announcing publication of geologic maps of San Miguel and Mora counties.

Copies of the charts, issued as Preliminary Map 54 of the Oil and Gas investigations series, may be purchased this week at 60 cents each from the survey offices in Washington, Denver or Tulsa.

The survey also has issued a new report on studies of the range and variation in grain size of petroleum reservoir rocks in the Appalachian Basin dealing with the Paleozoic and sandy limestones, supplementing a previous report on the Mississippian, Upper Devonian and Lower Pennsylvanian sandstones. Copies of both reports may be obtained without charge from Washington.

A two-volume report on the mineral resources of the Trinity River Tributary area of Texas and Oklahoma, discussing the location and distribution of oil and 28 other mineral raw materials, has been placed on file for public reference in the Survey offices in Washington and at the Bureau of Economic Geology of the University of Texas, the Oklahoma Geological Survey at Norman, the Trinity Improvement Association, Fort Worth: Chamber of Commerce, Dallas; and the post offices at Liberty and Crockett, Texas.

Berge Is Speaker

Assistant Attorney General Wendell Berge, in charge of antitrust enforcement, will be the principal government speaker at a one-day convention to be held in Chicago September 27 by the National Oil Marketers Association.

Berge will speak on the application of the antitrust laws to the petroleum industry, and may reveal the position of the Department of Justice on recent congressional proposals to investigate the possibilities of monopoly in oil marketing.

THE OIL MAN'S CALENDAR

SEPT. 9–13	American Chemical Society, Including Petroleum Division, Annual Meeting, Chicago.
10–12	Pacific Coast Gas Association, Annual Convention, San Francisco, Fairmont Hotel.
18–20	National Petroleum Association annual meeting, Atlantic City, Hotel Traymore.
18–20	Oklahoma Liquefied Petroleum Gas Association Annual Convention, Oklahoma, City, Skirvin Hotel.
20	Gas Division, Oklahoma Utilities Association, Annual Fall Meeting, Biltmore Hotel, Oklahoma City.
25	API Directors Meeting, New York, Carlton Hotel.
26	National Petroleum Council, Washington.
OCT. 1– 2	American Association of Oilwell Drilling Contractors, Annual Meeting, San Antonio, Plaza Hotel.
3– 5	AIME, Petroleum Division, Annual Meeting, Galveston, Hotel Galvez.
7– 9	American Society of Mechanical Engineers, National Conference, Mayo Hotel, Tulsa.
11	California Natural Gasoline Association Annual Fall Meeting, Los Angeles.
7–12	American Gas Association, Annual Convention, Atlantic City, N. J.
16–18	Texas Mid-Continent Oil and Gas Association, Houston, Rice Hotel.
24–25	AIME, Petroleum Division, Annual Meeting, Los Angeles, Ambassador Hotel.
24–25	American Association of Petroleum Geologists, Mid-Year Meeting, Biloxi, Mississippi, Buena Vista Hotel.
28–30	Independent Petroleum Association of America, Annual Meeting Fort Worth.
NOV. 11–14	American Petroleum Institute, Annual Meeting, Chicago, Stevens Hotel.
21–23	Rocky Mountain Oil and Gas Association, Annual Meeting, Denver, Shirley-Savoy Hotel.
DEC. 4	New Mexico Oil & Gas Assocation, Annual Meeting, Artesia.

☆ West Texas

Block 12 Activity Increased To 29 Operations, 14 Working

Block 12 field activity increased to 29 operations, with 14 under way, and tests may be assigned all 35 short-term leases; outpost to Kent County Ellenburger discovery area is below the projected water level; 2 Ector County prospects fail in Ellenburger.

Andrews County: Four wells are in process of completion near the Block 12 Clear Fork discovery that precipitated a large-scale drilling rush to develop production on University leases due to expire November 14 unless productive. The Atlantic Refining Company, which scheduled 15 tests, with 9 active and 4 starting up this week, was completing University-Texu 1-C-12, C NE SW Sect. 10 and ⅞ mile north by east of the discovery. This outpost was flowing 3 to 4 barrels of oil hourly after using 8000 gallons of acid in the Clear Fork at 7280 feet. The Texas Company's University 1-Q, south offset to its discovery, was testing after cementing 5½-inch pipe at 7111 feet within 6 weeks after spudding. Texas is starting University 2-R as its second test on the quarter section lease due to 1-R having difficulty with cavity at 4022 feet and above, while derrick is up for 1-T. The Superior Oil Company succeeded in boosting the oil flow from its 2 wells in process of completion by multi-stage acid treatments. Seaboard Oil Company has rigged up for 2 tests, while Plymouth Oil Company's University-Superior 1-B has been located at C SE NE Sect. 8, northwest edge of development. Pete Wiggins and Ed. Hyde are negotiating for tests on their acreage in this sector. Phillips Petroleum Company's University 1-O, a mile plus west by south of production, is due to reach the pay level soon.

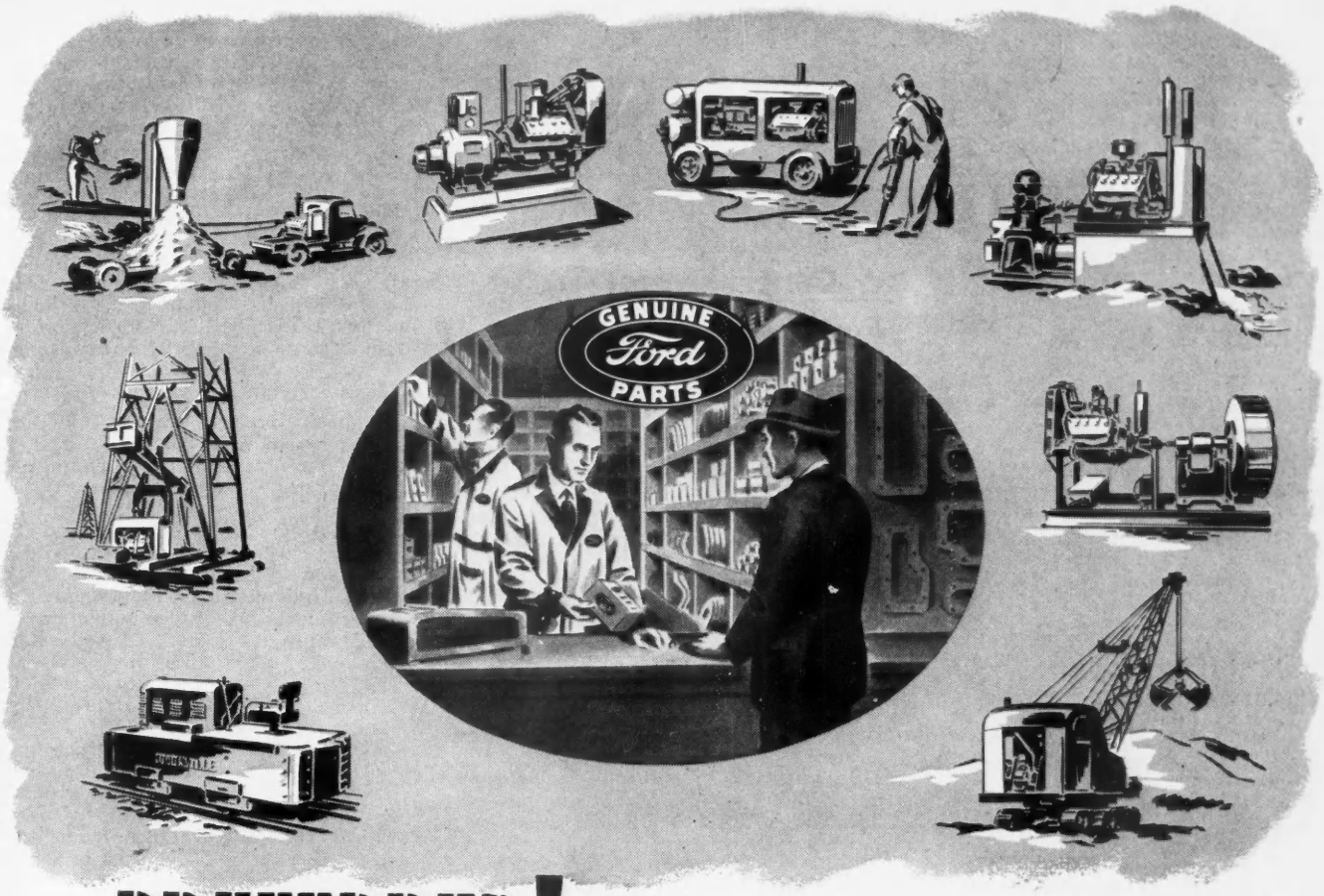
Sinclair Prairie Oil Company's University 1-160, C NW NW Sect. 41, Block 13, ½ mile east outpost for the South Fullerton - Devonian field, cemented pipe above the Devonian, topped at 8575 feet, or 184 feet low. However, it is 95 feet high on this marker when correlated with the field's southern producer.

Ector County: Cities Service Oil Company's Parker-Wentz 1, Harper area, abandoned efforts to make a producer from the Ellenburger, and will test by stages up the hole. Test of Basal Simpson at 12,226-245 feet yielded a trace of oil and some salt water.

Stanolind Oil & Gas Company et al's Kayser Unit 1, 1¼ miles southwest of the South Cowden field, drilled 123 feet of Ellenburger to 13,623 feet without indicating production, and was running pipe. Several prospective producing zones were passed up.

Shell Oil Company's Thomas 3, NE NE T&P Ry. 28, and northwest offset to the 10,800-foot Ellenburger discovery on the southeast side of the TXL field and across a fault, found the Ellenburger barren, and was plugging back from 11,051 feet to try for Clear Fork production.

Phillips Petroleum Company's Scharbauer-Weyman 1, southeast offset to the Clear Fork pay discovery on the north end of the Goldsmith field, registered potential of 485 barrels of 40.6-gravity sweet oil, with gas-oil ratio 1802/1,



PREFERRED! for the way they SERVE . . . and the way they're SERVICED!

The more a man has to depend on any engine-driven industrial unit on the job, the bigger the advantages a Ford-built engine will give him.

Ford engine reliability, efficiency and economy are time-proved *facts,* known and accepted the world over. And when you back up these facts with famous, universal Ford Dealer Service, you have an unbeatable combination.

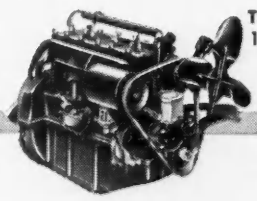
Thus, Ford-powered equipment is easier to sell. And the use of a Ford engine eliminates any need for the equipment manufacturer or distributor maintaining extensive engine service parts stocks. Ford Dealers and Parts Distributors gladly shoulder that responsibility.

You'll see more and more fine and popular equipment powered with these great engines, now that they're available once more. Light plants, pumps, compressor units, portable power units, saw rigs, mills, blowers and many other pieces of equipment have been developed with Ford engines to furnish the sure-fire power.

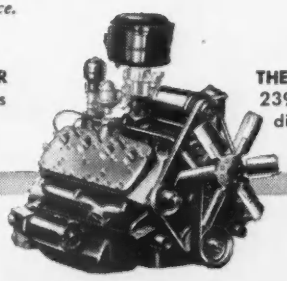
The three popular Ford-built engines, shown below, are now available to manufacturers and individual purchasers. Each offers reliable, enduring power applicable to a wide range of uses. For detailed specifications and dimensional data, write—

FORD MOTOR COMPANY
Industrial and Marine Division, Dept. 40
DEARBORN, MICHIGAN

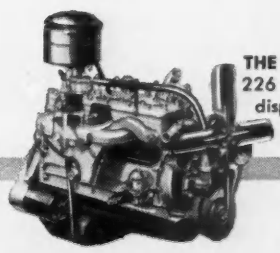
Specifications and designs subject to change without notice.



THE 40-HP FOUR
119.5 cubic inches displacement.



THE 100-HP V-8
239 cubic inches displacement.



THE 90-HP SIX
226 cubic inches displacement.

FORD-BUILT ENGINES

NOW AVAILABLE FOR INDUSTRIAL AND MARINE POWER

through ¼-inch choke after acidizing perforations at 6110-6280 feet. Considerable development is due to follow in this area, while in the meantime an Ellenburger test has been contracted for near the apex of the Permian structure.

Kent County: American Liberty Oil Company's Connell-Young 1, 1⅜ miles northwest of the Polar pool discovery in Ellenburger at 7776-7810 feet, drilled below the water level established by the discovery and a near-by failure in halting at 7925 feet for a drill-stem test.

Failures: E. E. Fogelson and Cosden Petroleum Corporation's University 1-C-D, 1⅞ miles southeast of the Penwell-Ellenburger field deep strike, was abandoned at 9357 feet in Ellenburger, topped at 9316 feet, or 443 feet low. The next Ellenburger exploration for this structure will be to the southwest.

Shell's Pinson-Humble 1, ¾ mile southwest of its Nelson field, Andrews County, discovery in Ellenburger, was abandoned at 10,845 feet in dolomite after testing oil and water in Ellenburger, topped at 10,650 feet, or 279 feet low.

Pension Plan Liberalized by Standard Oil Company of Ohio

A liberalization of the pension plan of Standard Oil Company of Ohio has been announced by W. T. Holliday, president.

Approved by Sohio's board of directors, the new provision provides that an employe with the company for 20 years or more, who has contributed to the company's pension fund for ten years, retains the company's full contribution to his pension even though he leaves Sohio's employ.

Previously, employes leaving the company only withdrew their contributions to the fund.

A further new provision permits an employe who leaves the company to continue his pension payments to the life insurance company for a larger pension when he desires to retire.

☆ Central West Texas

Expanded Wildcatting Paying Off With Prospective Strikes

Expanded wildcat operations paying off with numerous prospective discoveries; search for reef type structures centers upon Jones County; semi-wildcat in northeastern Stephens County showing for deep producer; Manning-O'Connor field due to embrace considerable area.

Jones County: R. H. Roak et al's Pitzer 1, Labor 25, League 150, DeWitt CSL Survey, 3½ miles west by north of the Stith pool, temporarily passed up probable commercial production from the Strawn, and was drilling at 5110 feet to explore the Ellenburger before running pipe. This wildcat entered dry Swastika at 2944 feet, with elevation of 1792 feet, and logged Strawn oil sand at 4539-49 feet. A drill-stem test at 4576-96 feet, and below the main pay, yielded gas to the surface in 16 minutes, and the well headed oil. The well owners paid unusually high prices for royalty in the area. Roark et al's Cade 1, NWc Labor 4, League 150, and 2½ miles northwest of Pitzer 1, showed oil and gas in Strawn at 4535-50 feet, with elevation of 1831 feet, and encountered casing trouble while bottomed at 4603 feet. An attempt will be made to test the Strawn and upper showings.

V. E. Autry, West Central Drilling Company, and M. M. Garrett's Minter 1, recent Swastika discovery on the west side of the county, flowed 108 barrels of 44-gravity oil, with gas-oil ratio 600/1, on 9-hour natural test through 5/16-inch choke. Production is from perforations at 3436-43 feet, although the flow did not occur until perforations were made opposite the bottom 5 feet. Mudge Oil Company has scheduled an east offset.

Stephens County: Palmer Oil Corporation's Caudill 1, SW SW SE R. S. Owings Survey A-132, is extending the Shaw-Stround area ½ mile northeast, rated as a 90-barrel pumper after nitro shot at 4141-62 feet in Marble Falls, topped at 4045 feet. This semi-wildcat was drilled to Ellenburger at 4850-5150 feet, then plugged back by stages.

Competitive drilling is under way in the Manning-O'Connor 5-well Bend lime field, and 5 additional tests are under way, or starting. Roeser-Pendleton, Inc., and J. D. Sandifer, Jr.'s Brooks 1, SE SE SE T&P Ry. 41, Block 7, scored the second largest well in extending the field ⅜ mile northwest with a flow of 476 barrels of 44-gravity oil with gas-oil ratio of 735/1 through 22/64-inch choke from open hole at 3304-15 feet. The area is subject to important extensions, except to the southwest.

Taylor County: The search for reef

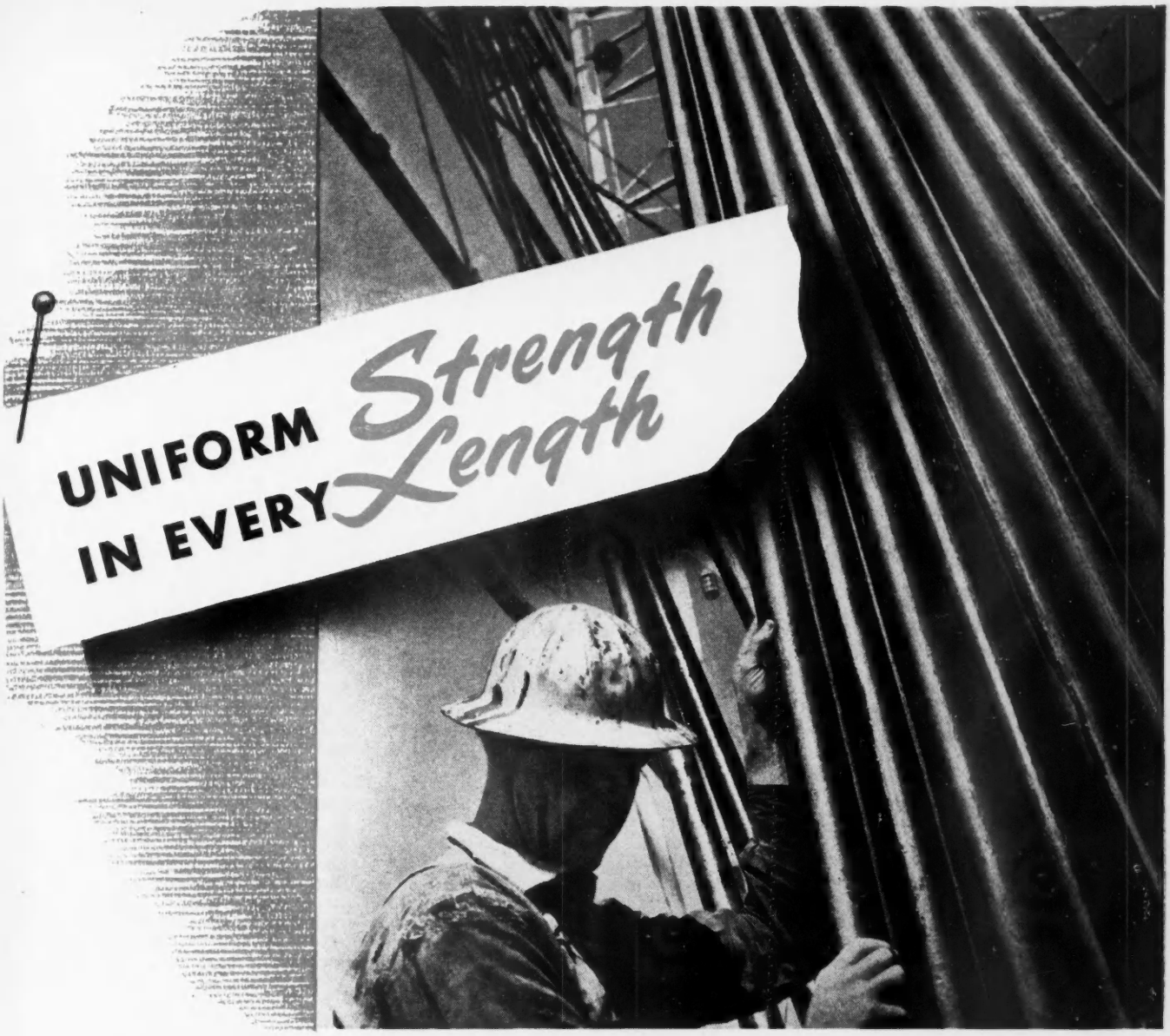
A-1 FACTORY FOR SALE

FOR SALE DUE TO DEATH OF FRED I. GETTY, OWNER

Modern Oil-field Tool, and Equipment Factory. Buildings New in 1938. Well Screen and Packer Business Continuous Since 1907. Located on U. S. Highway 90, and on Main Line, Southern Pacific (Spur Onto Property) at Jennings, La. Air-conditioned Office, Ample Vault and Furnishings.

INSPECTION AND OFFER INVITED—Address: Mrs. F. I. Getty, Jennings, La.

Shop 18,000 sq. ft., fine modern machinery including new 27 in. x 20 ft. Lehman Hydrotrol Engine Lathe, 13 in. Hollow Spindle, 25 h.p. Connected Motor, complete with two Chucks and Accessories. Property fenced. Inventory $252,000.



Every length—every foot of Republic Electric Weld Casing and Tubing is tough, strong, able to stand up under severe external pressures without collapsing. As a consequence, you can use these products with full assurance that they will provide dependable service under the most difficult conditions.

And here are the reasons for the uniform strength of Republic Electric Weld Casing: Its high physical properties are secured by cold working rather than from high carbon content. Formed from flat rolled steel, the top of the plate becomes the inside of the pipe. Thus, it can be accurately inspected before fabrication. Republic's improved method of electric welding makes the weld as strong as the wall.

For dependable service, insist on Republic Electric Weld Tubing and Casing. Over 130,000,000 feet of this time-tested product have demonstrated their money-saving performance in service.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

INSPECTED INSIDE AND OUT

Republic Electric Weld Casing and Tubing are made from flat rolled steel, both sides of which can be inspected. Thus, the surface which becomes the inside wall is free from hidden defects.

REPUBLIC *Electric Weld*
LINE PIPE
NORMALIZED CASING AND TUBING

Other Republic Products include Alloy Steels—Upset Studs, Bolts and Nuts—Electrunite Heat Exchanger Tubes

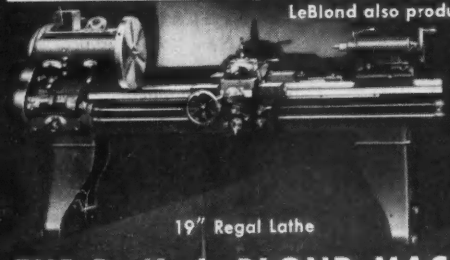
When the work's all done this Fall...
HERE'S THE SPOT TO RELAX!

During the Indian Summer days ahead, enjoy a perfect, carefree vacation at Cliff Lodge on the CIRCLE D RANCH. Located on highway 27, just fifteen miles from Kerrville on the Junction Road. It is the spot ex-Cable Tool Driller P. R. Douglas visited and refused to leave. Now he operates it for your pleasure and enjoyment. Call or write for reservations.

WHAT'S INCLUDED AT A REASONABLE COST
★ Horseback Riding
★ Swimming in Spring Fed Pool
★ Fishing and Hunting
★ Tennis and Badminton
★ Delicious Food Served Ranch Style

CIRCLE D RANCH
Telephone INGRAM 14-12
KERRVILLE, TEXAS
MEMBER OF TEXAS HILL COUNTRY DUDE RANCH ASSOCIATION

LeBLOND OIL COUNTRY LATHES
For accurate high speed turning to API specifications. LeBlond also produces for the oil country machine shop:


19" Regal Lathe

Hollow Spindle Lathes—16", 18", 27", and 30". Heavy Duty Engine Lathes—12" to 50" sizes. Regal Lathes—13" to 24" sizes. No. 2 Cutter Grinder.

THE R. K. LeBLOND MACHINE TOOL CO.
DEPT. R-19 CINCINNATI 8, OHIO
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

type structures along projected production trends has gained this county 2 additional wildcat projects. Paul Steed and W. W. Wilson, Jr., are starting Norwood 1, SW NE NE T&P Ry. 10, Block 5, as a Palo Pinto, or 4000-foot test. Owners have assembled a supporting block of 4000 acres.

☆ North Texas

Montague County Test Makes Important Deep Oil Strike

Montague County has important deep oil strike; Jack County gas discovery has small yield; Ellenburger failure on Sherman prospect will plug back to test Strawn oil sands.

Montague County: Continental Oil Company and Staley Oil Company's Lewis 1-B, southwest corner of a 77½-acre lease, N. S. Ussery Survey A-824, confirmed favorable geophysical picture in developing natural flow from conglomerate in Bend, topped at 6176 feet. Pipe was cemented in shale at 6456 feet to complete through perforations after a drill-stem test at 6450-60 feet yielded gas to the surface in 1 minute and the well started flowing oil in 4 minutes. Bottom-hole pressure registered 2650 pounds in 10 minutes. The conglomerate pay was entered at 6348 feet and based at 6403 feet, with elevation 1060 feet. This wildcat is 2½ miles southeast of the Hildreth 148-well field from the same zone but averaging 100 feet higher.

Jack County: Continental's Cherryhomes 1-C, F. Payne Survey A-1564, opened a new gas area in testing ¾ million cubic feet daily from perforations at 4590-4600 feet in Bend conglomerate, topped at 4574 feet. Continental's McGaughey 1, SWc Sect. 19, J. J. Gholson Survey A-229, a mile southeast of the Risch pool, was abandoned in shale at 5010 feet, having entered the Bend at 4203 feet.

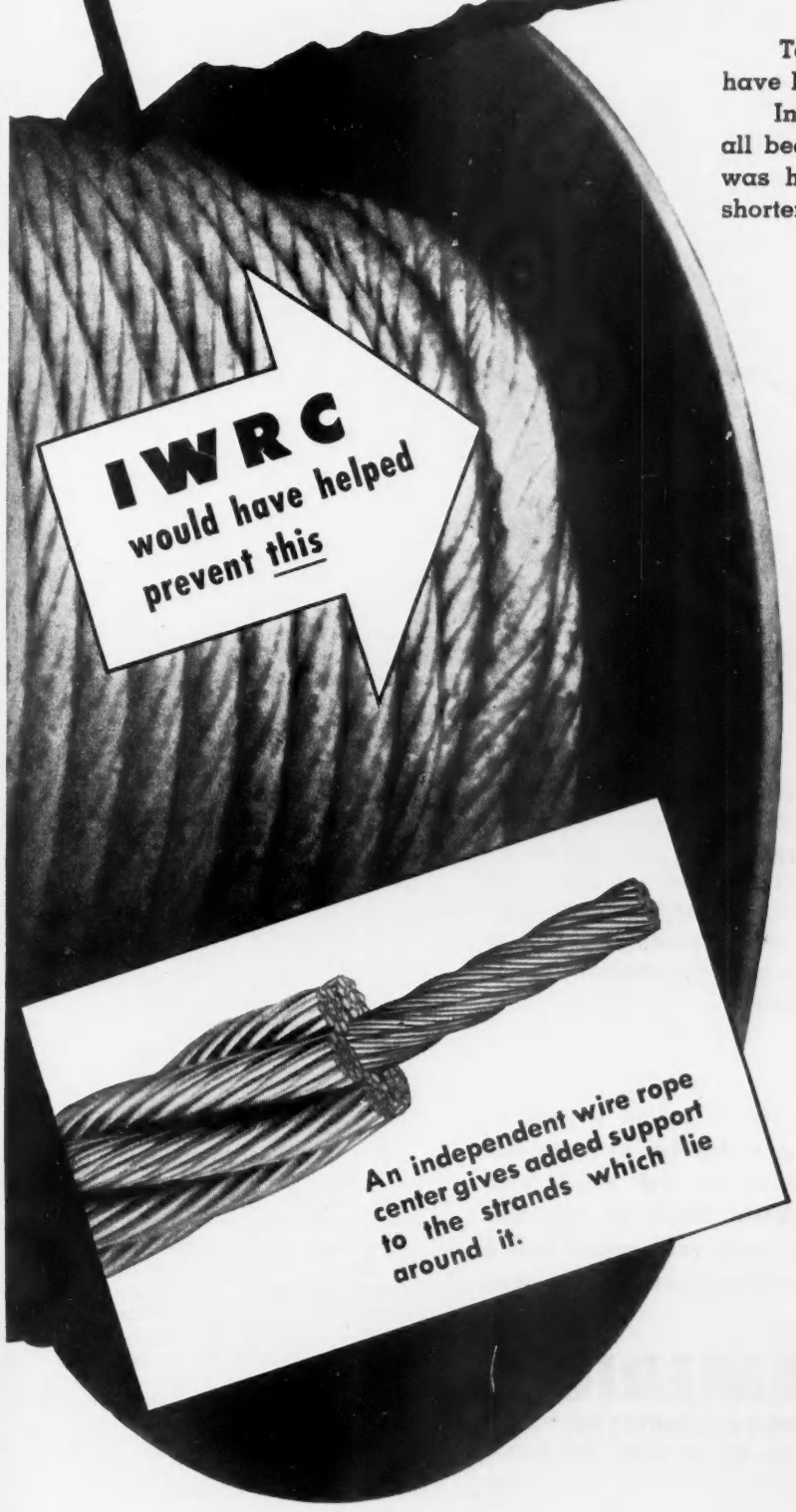
Grayson County: Standard Oil Company of Texas' Mitchell 1, Sherman prospect, failed to encounter any shows that warrant tests in drilling Ellenburger to 11,541 feet. This wildcat sets a new depth record for the district by a wide margin, and is supported by a block of about 20,000 acres assembled on geophysical information. It will be plugged back to try for completion in several promising Strawn oil sands. The company's Grayson County Poor Farm 1, ¾ mile northwest of the deep test, missed the Strawn shows, and was abandoned at 5200 feet.

The Texas Company's Handy 3, offset to its 1665-foot flowing discovery for the Handy pool, showed ¼ million cubic feet of gas from perforations at 402 feet, with hole bottomed at 1286 feet.

Sees Many Abandonments When Subsidy Discontinued

John G. Catlett of Tulsa, executive chairman of the National Oil Conservation Committee, sharply criticized the reduction in subsidy payments to stripper well operators ordered by Washington and declared that the reduction

This Piece of Rope is Doomed
(NEXT TIME THEY'LL USE IWRC)


IWRC
would have helped
prevent this
An independent wire rope center gives added support to the strands which lie around it.

Too bad. It was a good wire rope, and it could have lived a long, useful life.

Instead, it's doomed to an early scrapping—and all because of crushing on the drum. The crushing was hastened by very poor spooling, which will shorten the life of any rope.

In some rope service, even with the best of spooling, it is difficult to avoid heavy, crushing pressures. But you can help counteract such pressures by purchasing rope with an IWRC (independent wire rope center).

An independent wire rope center is a separate little rope in itself—a rope within a rope. It performs the same duty as the conventional hemp core, but is naturally stronger, less yielding under pressure.

With IWRC, you may sacrifice a minor amount of flexibility. Nevertheless, where the hazard of crushing is present, IWRC should be specified. Under these conditions, it will substantially prolong rope life.

Why not review your roping needs with a Bethlehem engineer? If he finds you need IWRC, he'll recommend it—but only where it will actually work to your advantage.

BETHLEHEM STEEL COMPANY
Bethlehem, Pa.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

When you think WIRE ROPE . . . think BETHLEHEM

was unjustifiable and will result in heavy losses to marginal producers and to other interests. The order reduced the subsidy by 25 cents per barrel.

"The cut in the price of crude oil to stripper-well operators by reducing the subsidy was unjustifiable, since oil was selling at a price far below that of other commodities," Catlett stated. "The reduction comes with poor grace since the operators were forced to produce and sell their oil at a price far below the cost of replacement during the war. Oklahoma, with 95 percent of her wells in the stripper class, will be particularly hard hit by this act which is a step toward mass abandonment of wells so characteristic prior to subsidy payments. The loss to this state in tax revenues, employment, and millions of barrels of oil will have serious economic effects upon the state.

"With the continued assistance of the oil operators and public-spirited citizens, the National Oil Conservation Committee will redouble its efforts for a conservation payment for stripper oil reserves so vital to our national economy and national safety."

☆ East Texas

Navarro County Strike to Be Reworked Due to Water Volume

Navarro County deep discovery to be reworked due to excessive volume of water; Woodbine discovery in Wood County pumping unusually low-gravity oil; northwest offset to Mount Sylvan field discovery correlates flat on Georgetown marker.

Navarro County: Temple Hargrove et al's Wallace 1, John Jones Survey and 1000 feet northwest of Woodbine production on the Richland Currie fault trend, is to be reworked after production settled to 10 barrels of fluid hourly, including 10 percent 30-gravity oil, through ⅛-inch choke. This production is from Rodessa perforations at 5447-54 feet. Tubing pressure recorded 50 pounds, while casing pressure was 1500 pounds. New perforations are due to be made higher in the zone, while test may be made of porous zone in the Pettit at 5905-20 feet.

Wood County: Bobby Manziel and Bill Bridewell's Amason 1, Hazard Anderson Survey, Oak Grove prospect, pumped 253 barrels of 16½-gravity oil initial from perforations at 5466-88 and 5237-46 feet in Woodbine, topped at 5237 feet. This discovery cut fault at 5095 feet. The oil compares with the lowest grades produced in the Hawkins field.

Delta Drilling Company and W. J. Weaver's McKenzie-Esun 1, Joe P. Wood Survey and 2 miles northeast of Alba, was drilling at 4580 feet and reported to be low for the area. A drill-stem test of the Woodbine at 4260-4380 feet yielded 2100 feet of salt water.

Smith County: Humble Oil & Refining Company's Moseley 1, northwest offset to its Mount Sylvan pool discovery, was drilling at 6130 feet, having entered the Georgetown lime at 5977 feet, or flat with the producer. The Woodbine, topped at 5099 feet, correlates 2 feet high.

Bowie County: Delta Drilling Company et al's Gauntt 1-A, Jas. Giles Survey, was abandoned at 4150 feet in Paluxy, topped at 3938 feet. This failure is a twin to a 3716-foot junked hole.

Corrosion Suggestions to Get Actual Pennsylvania Tests

Experiments will be conducted on 25 oil wells in the Oil City-Pleasantville district to test several laboratory-developed ideas for controlling corrosion in oil producing operations under air-gas secondary recovery. The Pennsylvania Grade Crude Oil Association will sponsor the study.

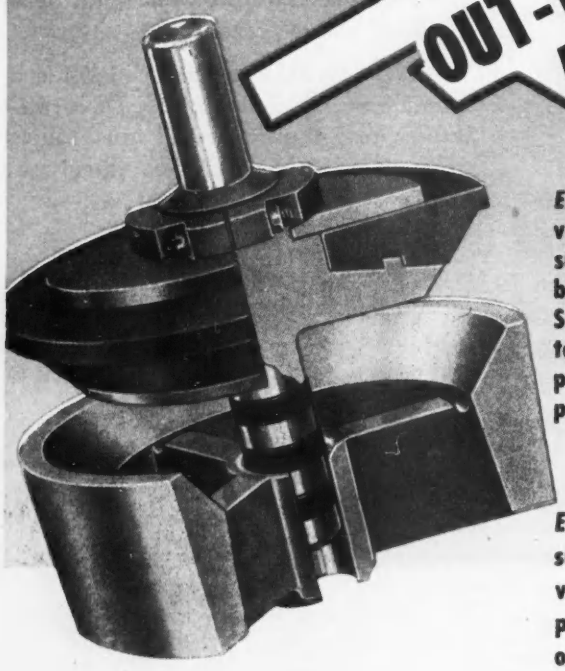
C. E. Stout of Parkersburg, W. Va., production research engineer for the association, said six operators have consented to cooperate in the tests on nine separate leases spread throughout the district.

The Battelle Memorial Institute, Columbus, Ohio, engaged last year to make a special investigation of the corrosion problems for the association, suggested investigation of use of zinc chromate and a preparation known as Calgon, either in combination or separately, as a means of protecting present well equipment. Temporary benefit might be derived from use of a rust preventive coating to be swabbed outside the tubing each time the well is pulled, the Institute said. Other suggestions included elimination of galvanic couples between the brass barrel and the adjacent steel parts by means of insulated section or use of zinc protectors. Galvanized rods and tubing were recommended for use in replacements.

EXCLUSIVE features

explain why "AMERICAN" Valves & Seats are...

OUT-PERFORMING ALL OTHERS



Exclusive 3-web design of valve seat gives complete support and adequate distribution of load for *longer life!* Seats stand up under the terrific pounding, the high pressure, of modern power pumps!

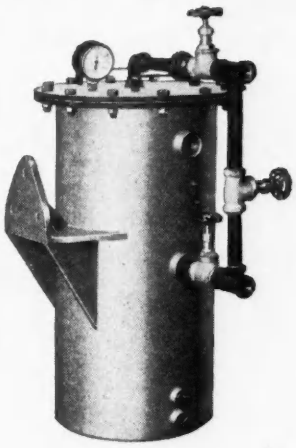
Exclusive design provides a successive 4-point contact of valve on seat which completely *distributes the load* of every valve-impact over a maximum area of the seat.

Exclusive design provides three composition rings on valve stem which *reduce wear* on stem and valve seat!

AMERICAN
IRON & MACHINE WORKS CO.
OKLAHOMA CITY, OKLAHOMA
Office & Warehouse, Houston, Texas
Export Office: 420 Lexington Ave., New York City, N.Y

Remember, there is an "American" service man in every active field!

SUN OIL FILTER FOR
Diesel Fuel and Diesel Lubrication



FEATURES

Efficient

Convenient

Low first cost

Low operating cost

You will like it

No. 8-45 Diesel Fuel

Write or wire for full details

W. L. CLAY

Manufacturer

1529 West Main St. Oklahoma City, Okla.

STOP CORROSION

at LOW cost and big savings on your*

- Pulling Costs
- New Steel
- Shutdown Time

with THOMPSON-HAYWARD

FORMALDEHYDE

for corrosion control

*Dependable protection for sucker rods and parts from hydrogen sulphide corrosion and corrosive mine and well waters.

Ask our nearest representative for detailed facts

THOMPSON-HAYWARD CHEMICAL CO.

Dallas Houston Denver
Wichita Tulsa San Antonio
New Orleans

(A)

LEASE FORMS

for

Alabama-Mississippi and Florida-Georgia

Available for Immediate Shipment from Stock

Form 311-A.M.—Designed for use in Alabama and Mississippi

Form 311-F.G.—Designed for Use in Florida and Georgia

Order by Form Number

Both of these forms were prepared by leading oil attorneys and lease men and are in use by both majors and independents.

Write, Wire or Call Your Order to

STOCK FORM DEPARTMENT

THE GULF PUBLISHING COMPANY

P. O. Box 2608 Houston 1, Texas

Telephone Hadley 3141

DON'T PAINT Your Rope—the flexibility of rope makes it impossible to maintain an unbroken paint coating as weather protection. Water will seep through the cracks and breaks in the paint; and won't evaporate as rapidly as from clean rope. This moisture invites mildew and internal rot, weakens the rope and soon makes its use hazardous.

Now, while good rope is still hard to find, it pays to take care of the rope you have. When you do buy new rope—*specify New Bedford—that pays too!*

NEW BEDFORD CORDAGE CO.

233 BROADWAY • NEW YORK 7, N. Y.

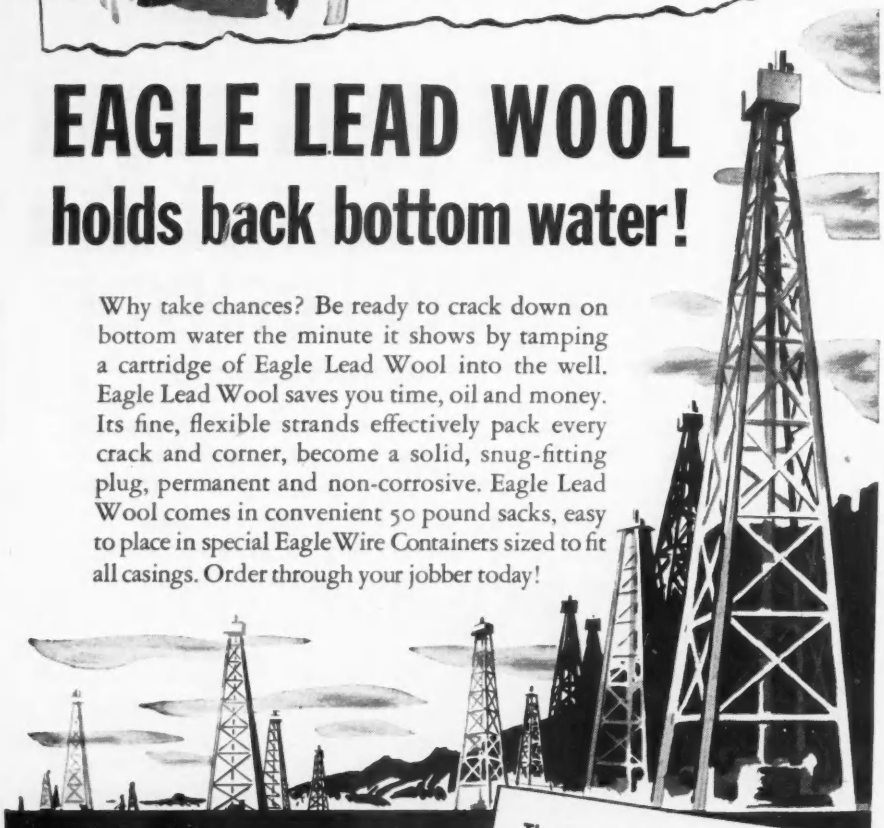
31 St. James Ave., Boston 16, Mass. • 325 W. Huron St., Chicago, Ill.

Mills: New Bedford, Massachusetts

AS A DAM HOLDS BACK THE FLOOD...

EAGLE LEAD WOOL
holds back bottom water!

Why take chances? Be ready to crack down on bottom water the minute it shows by tamping a cartridge of Eagle Lead Wool into the well. Eagle Lead Wool saves you time, oil and money. Its fine, flexible strands effectively pack every crack and corner, become a solid, snug-fitting plug, permanent and non-corrosive. Eagle Lead Wool comes in convenient 50 pound sacks, easy to place in special Eagle Wire Containers sized to fit all casings. Order through your jobber today!



EAGLE EP PICHER EAGLE LEAD WOOL

Seals off bottom water —keeps 'em flowing!

These 3 Eagle Bearing Metals meet most requirements . . .

Eagle Dreadnaught—for extreme speed and pressure conditions.

Eagle Outlasta—for medium speed and pressure conditions.

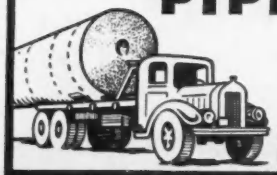
Eagle Durable—for low speed and pressure conditions.

THE EAGLE-PICHER COMPANY

Chicago • Joplin • Cincinnati • Dallas • Kansas City

Oil Field *and* Specialized Hauling

PIPE STRINGING—



SERVING:— Arkansas, Illinois, Indiana, Kansas, Kentucky, Louisiana, Missouri, New Mexico, Oklahoma, Tennessee and Texas.

NEW TRUCKS EQUIPPED WITH POWER WINCHES, LOWBOYS, TANDEM AND SINGLE-AXLE TRAILERS

THOMAS MOTOR FREIGHT

DALLAS OFFICE
5220 HINES BLVD. L-6-5261

TULSA, OKLA., OFFICE
1902 EAST 7 PL. 4-3652

☆ East Texas Border

Carthage Outpost Plans Test; Offset to Be Dual Completion

Carthage outpost preparing to test; offset to Harrison discovery well will dual complete; Whelan outpost reported successful gasser.

Panola County: Delta Drilling Company's Christian 1, Carthage wet gas field, 3800-foot east outpost operation, halted at 6546 feet and set casing after finding 10 feet of sand with distillate odor at 6125-35 feet. This well, 3800 feet east of nearest production, is in the Travis Peak.

The week gave the Carthage field its best oil producer and its biggest gasser. On the northwest edge of the field, Skelly Oil Company recompleted S. E. Matthews 1, William McFadden Survey, for 480 barrels of 43-gravity oil daily through 3/8-inch choke from Lower Pettit perforations. In April it was completed flowing gas from the Upper Pettit, and 14 barrels of oil from the Lower Petit. Phillips Petroleum Company's Naomi 1, John Lee Survey, reputedly the field's biggest gasser, was assigned daily open flow potential of 640 million cubic feet from the Lower Pettit.

Harrison County: Rogers Lacy's Abney 1, Simpson Holloway Survey, south of E. C. Johnson's Cargill 1, discovery well, gauged 64.8 barrels of oil in 24 hours from the Travis Peak at 6004 feet. Testing of the Pettit was under way at 5660-80 feet, with dual completion scheduled.

Placid Oil Company's Dunn 1, W. S. McBride Survey, appeared to be a 1 mile west extension to the Whelan field. No gauge of gas production has been reported of tests between 6863-7954 feet.

Find Helicopter-Borne Magnetometer Effective

Greater speed and accuracy heretofore unattained are accomplishments of the helicopter-borne, highly sensitive magnetic instruments developed by Dr. Hans Lundberg in conducting geophysical surveys for mineral deposits and described in *Mining and Metallurgy*. Use of the helicopter and Dr. Lundberg's instruments have resulted in more detailed data concerning areas in Canada where previous land surveys and conventional air-borne surveys have been made. Recordings are made at altitudes ranging from 150-250 feet above the ground level.

The helicopter may be equipped with floats for operations in swamps and lakes where results obtained from a two-hour survey, equivalent to a 108-day conventional ground survey plus the 60 additional days required to cut lines, have provided exceptional detail on the anomalies covered.

☆ South Central Texas

Charlotte Field Outpost Test Is Swabbing for Completion

Dimmitt County wildcat abandoned; Charlotte outpost swabbing for completion; 2 wildcat operations under way in Edwards County.

Dimmitt County: Humble Oil & Re-

fining Company's Johnson 1, wildcat in the Carrizo Park area, has been abandoned at 4194 feet. A drill-stem test was made at 2840-46 feet, and recovered 245 feet of oil-cut mud and 25 feet of salt water. The dry hole is in the center of Lot 13, Carrizo Park Subdivision, San Antonio Valley Ditch Company Survey. Rig from Johnson 1 is being moved 1½ miles west for Johnson 1-B.

Atascosa County: The Texas Company's Earl D. Scott 1, southeast outpost test at Charlotte field, is still swabbing for completion. Drilled to 5404 feet, 7-inch casing was set to 5396 feet and perforated for completion at 5294-5305 feet. Scott 1 is 1900 feet from the east line and 2700 feet from the southwest line of J. Poitevent Survey 3, A-690, and 1 mile south-southeast of the company's Love 1.

Edwards County: Two wildcat operations are under way in the county. Dan Auld's Hal C. V. Peterson 1, 6 miles northeast of Rock Springs in SW¼ SE¼ AB&M Str. 16, Block 2, milled out junked 7-inch casing down to 3500 feet and sidetracked at 3470 feet. At last report tools were below 3485 feet scheduled for 5500 feet. Ray E. Pool's J. S. Peterson 1, in W¼ N¼ Sect. 44, M&E RR Survey, 20 miles north of Rock Springs, recemented surface pipe after it parted, causing loss of returns. This test topped the Pennsylvanian at 909 feet and was at 2981 feet at last report.

☆ Southwest Texas

Test Near Sun Field Coring; Sunray's Wildcat Abandoned

Wildcat south of Sun field coring; Sunray's Starr County wildcat abandoned; Charco Redondo well testing; Peters field well shut down after testing salt water.

Starr County: Sun Oil Company's C. M. Hall 1-A, deep wildcat test ⅔ mile south of the Sun field, is coring sands around the 5800-foot level. This test is 1320 feet from the north and east lines of the CCSD&RGNG Survey 271 and is scheduled to be drilled to 8000 feet.

Sunray Oil Company abandoned J. H. Clopton 1, wildcat, at total depth of 3318 feet. It is 1100 feet from the west line of Porcion 87 and 9180 feet north of the Rio Grande.

Zapata County: F. P. Schwab et al's Anastacio Garcia 1-A, Charco Redondo field, stood with hole full of oil as crew prepared to test. Total depth is 1698 feet with 5½-inch casing set to 1690 feet. Saturated sand was logged from 1688-96 feet. This test is on a 440-acre lease, Charco Redondo Grant, 1200 feet southeast of the Garcia 2.

Duval County: At Peters field, R. M. Reed & R. W. Morgan's First National Bank of Bay City 2, 933 feet northeast of the No. 1 well, shut down after swabbing salt water. Drilled to 2479 feet, 5½-inch casing was set to 2475 feet and perforated at 2456-66 for initial test, recovering salt water. These perforations were squeezed and casing was perforated at 2224-28 feet where mud with a slight show of oil was swabbed. Latest perforations are at 2228-32 feet where salt water was swabbed.

Constant, careful control through every step of manufacture assures dependable performance, safety and long life in Wickwire Spencer Wire Rope.

HOW TO PROLONG ROPE LIFE AND LESSEN ROPE COSTS . . .

Thousands of wire rope users—old hands and new—have found "Know Your Ropes" of inestimable value in lengthening life of wire rope. Contains 78 "right and wrong" illustrations, 41 wire rope life savers, 20 diagrams, tables, graphs and charts.

For your FREE copy, write Wire Rope Sales Office, Palmer, Mass.

WICKWIRE SPENCER STEEL DIVISION
The Colorado Fuel and Iron Corporation
THE CALIFORNIA WIRE CLOTH CORPORATION

EASTERN GENERAL SALES OFFICE 361 DELAWARE AVE., BUFFALO 2, N. Y. | EXECUTIVE OFFICES DENVER 2, COLORADO | WEST COAST OFFICES OAKLAND 4, CALIFORNIA

☆ Lower Texas Coast

Burnell-Wilcox Outpost Tests After Cleaning Into Pits

Burnell-Wilcox outpost testing after cleaning into pits; deep wildcat southeast of Falfurrias testing; production try being made in Refugio County wildcat; La Sal Vieja outpost temporarily abandoned.

Bee County: Stewarts & George Brown's Brinkoeter 1, outpost 4000 feet southwest of production in the Burnell-Wilcox field, is testing for completion after cleaning into pits with tubing pressure 1425 pounds and casing pressure 2425 pounds. Flow is from perforations at 6860-63 feet with hole bottomed at 6864 feet. The test is 660 feet from the northeast line and 4250 feet from the northwest line of George Pagen Survey A-249.

Brooks County: Sun Oil Company's D. J. Sullivan 6, deep wildcat 4½ miles southeast of Falfurrias, is testing after drilling to 13,206 feet. With 5½-inch casing set to 12,180 feet, perforations were made from 10,280-293 feet, where the well flowed 40.71 barrels of condensate and 2,100,000 cubic feet of gas in 24 hours. These perforations were squeezed and further tests are being made up the hole.

Refugio County: Barnsdall Oil Company's Mrs. E. T. Morrow 1, wildcat 1¼ miles southwest of McFaddin field, recovered salt water during initial test of perforations at 6078-88 feet. These perforations have been squeezed and perforations at 2286-90 feet are being tested. Drilled to total depth of 7165 feet, this wildcat is in the northeast corner of Edward Perry Survey A-48.

Willacy County: Magnolia Petroleum Company and Abercrombie's Gustin Garrett 1, outpost at La Sal Vieja, has been temporarily abandoned after testing salt water from perforations at 8325-34 feet. Total depth is 10,278 feet and 7-inch casing is set to 8697 feet.

☆ Upper Texas Coast

Johnston Strike, Tidehaven Well May Have Different Pays

Johnston's Matagorda County discovery reportedly located on different structure and producing from different sand than Tidehaven well; new and deeper production opened at West Columbia; third well for Olive field completed; Olive outpost drilling deeper.

Matagorda County: Ralph A. Johnston's Live Oak Farms 1, 2 miles east-northeast of Blessing, is reportedly producing from a different sand and is on a different structure than Magnolia Petroleum Company's Live Oak Farms 1, 4500 feet to the north and the discovery well of Tidehaven field. Johnston's well was completed as a gas-condensate producer from perforations at 8756-72 feet, flowing an estimated 1 million cubic feet of gas with considerable condensate in 24 hours through ⅛-inch choke. Magnolia's discovery was completed as an oil well August 4, 1946, flowing 160 barrels of oil daily with no water from perforations at 8450-56 feet.

Brazoria County: Hogg Oil Company's Mike Hogg et al 10-A has opened new and deeper production on the east flank of the old West Columbia field. Test of perforations at 6106-22 feet in the Frio flowed 470 barrels of 33-gravity oil daily through ¼-inch choke with tubing pressure 500 pounds and gas-oil ratio 520/1. This well is 1900 feet southeast of the 9-A well and about 1750 feet northeast of the 3-A well.

Hardin County: Pan American Production Company has completed Olive Sternenberg Lumber Company 3, third producer for the Olive field. On potential the well flowed 215 barrels of 45.8-gravity oil daily through 10/64-inch choke with 2200 pounds flowing pressure on tubing and gas-oil ratio 2581/1. Total depth is 10,103 feet with 5½-inch casing set to 10,004 feet and completed in open hole, top of the saturated sand coming in at 10,068 feet. This well is 3000 feet west and 400 feet south of the discovery well in the field.

Pan American's Sternenberg 1-B, wildcat outpost 7000 feet north of production in the Olive field, is drilling below 10,800 feet after testing. The wildcat flowed at the rate of 10 barrels of fluid hourly in the test made with 7-inch pipe cemented to 9877 feet, packer at 9777 feet and total depth of 10,808 feet. Fifteen percent of the flow was oil and 85 percent muddy salt water.

☆ South Louisiana

Magnolia Is Drilling First Of Four Offshore Wildcats

Magnolia starts first of 4 wildcats in Gulf offshore from Terrebonne Parish; new producer for Mamou completed; 2 operations in progress at Weeks Island.

Terrebonne Parish: The first of 4 deep wildcats to be drilled in the Gulf off Terrebonne Parish by Magnolia Petroleum Company has been started. It is the State-Mineral Lease 673-1, on Tract 474, Block 58, 6 miles out from Point Au Fer field. At last report the wildcat drilled below 1800 feet after setting 404 feet of 20-inch conductor pipe. Projected depth is undecided but it will be a deep test.

Evangeline Parish: Magnolia has completed Morein-Landreaneau Unit 1 as a new producer in Mamou field. From perforations at 11,774-784 feet the well was completed for 235 barrels of 36.6-gravity oil daily through 8/64-inch choke with gas-oil ratio of 2475/1. Drilled as the west offset to the discovery well, the Morein-Landreaneau Unit 1 had oil saturation in the Morein sand from 11,557-579 feet and also had an oil show in sands at 10,610-620, 11,900-915, and 11,983-12,010 feet. Wilcox was topped at 11,508 feet.

Iberia Parish: Two operations are in progress at Weeks Island field. Humble Oil & Refining Company's Burgieres Company, Ltd. 1-B, in 44-14s-7e, was drilling at 10,400 feet at last report, scheduled for total depth of 14,000. Shell Oil Company's Myles Salt Company 1, 853.3 feet south of the Smith-State 1, discovery well for the field, drilled near 3000 feet after setting 10¾-inch casing to 2947 feet. The deepest producing wells in the world are in this field. They are Shell's Smith-State 1, producing from perforations at 13,505-520 feet, and the same company's Smith State 2, producing from the record depth of 13,763-778 feet.

Nervous Employers!

We need shirts, shoes, socks, cars, washing machines, pipe, equipment, building materials. Yet, according to the papers, manufacturers are still nervous because of impending strikes. Men want to work. They like their jobs and wages. But men are gullible—easily herded in groups like sheep, and milked of their substance and patriotism like goats. The American Humane Association is interested in the prevention of cruelty to animals and children only. There is no organized movement to discourage the racketeers who prey on labor while congress winks and leers. Westbrook Pegler crusades alone.

WE'VE SUPPLIED OIL MEN IN OUR AREA FOR 38 YEARS

PELICAN WELL TOOL & SUPPLY CO.

SHREVEPORT
LOUISIANA

PELCO

Berwick
New Iberia
Lake Charles

☆ North Louisiana

Final Testing Expected for Plain Dealing Deep Wildcat

Final testing of Plain Dealing area deep wildcat expected; deep test starting in old shallow Caddo field.

Bossier Parish: Barnsdall Oil Company's wildcat, Carter-Burton 1, C NW NW 26-23n-13w, swabbed oil and salt water after perforating from 6362-64 feet and treating with 3000 gallons of acid. This deep test went to 12,386 feet in the Smackover but plugged back to test Pettit porosity topped at 6320 feet.

Caddo Parish: N. A. Hendrickson has started operations on a deep test to include the Cotton Valley, in the northeast corner of the Caddo field, NE SW 5-20-15w, 2½ miles east of Oil City. Kerr & Magee Oil Company's Harry Johnson 1, wildcat, 6 miles northwest of Shreveport, was drilling at 5100 feet.

40-Acre Well Spacing Set for Oklahoma North Lindsay Pool

The Oklahoma Corporation Commission has issued an order establishing a 40-acre well spacing pattern for the deep North Lindsay pool of McClain County.

In granting the application of Cities Service Oil Company for a spacing pattern of one well in the center of each 40 acres, the Commission established a precedent which many oil men believe will be followed henceforth during the development of deep production in the Anadarko Basin. Hearings on the matter have been in progress for nearly a year and were initiated by Cities Service shortly after that company opened the North Lindsay pool.

☆ Arkansas

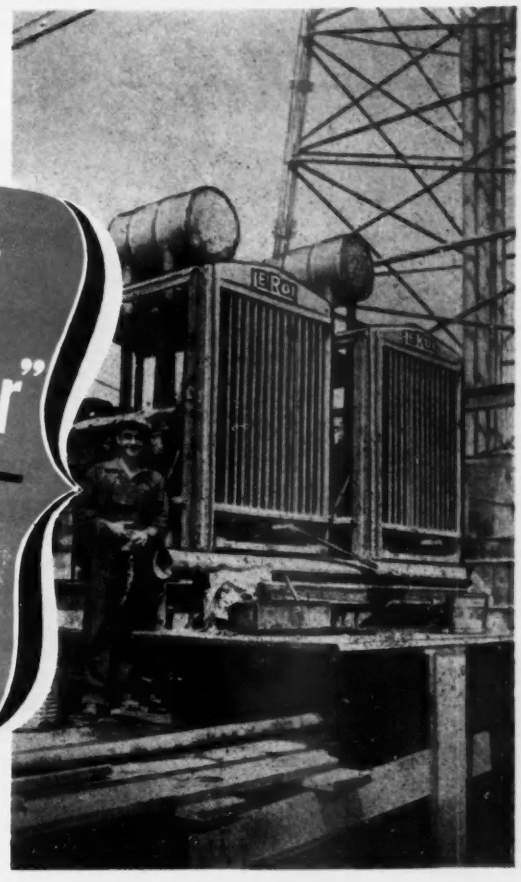
Wildcat East of Wesson Field Is Rated as Good Prospect

Ouachita County wildcat seems good prospect; 2 offsets to Spirit Lake discovery are below 3000 feet.

Ouachita County: Joe Mucher's Josie Smith 1, NE SE SW 30-15-17, at Pace City, 6 miles east of the Wesson field, swabbed perforations at 2800 feet, which yielded considerable oil and water. Pipe was perforated a little below 2600 feet in the Glen Rose sand. The lower perforations will be squeezed before finaling. A test taken in the Meakin sand at 2204-25 feet recovered 230 feet of oil and mud in 30 minutes.

Columbia County: McAlester Fuel Oil Company is erecting derrick on Alexander A-1, a wildcat, NE SE 17-17-19, 1 mile west of Village field production.

Lafayette County: The Carter Oil Company's C. B. Moore 1, SW SE 14-15-25, south offset to Stewart & Lewis' Spirit Lake discovery, H. Moore Estate 1, NW SE 14-15-25, was drilling around 3100 feet. Magnolia Petroleum Company's Moore Heirs 2, NE SE 14-16-25, an east offset to the Spirit Lake discovery, was drilling at 3310 feet, after cutting the fault. McAlester Fuel Oil Company has located Adams Estate 1, wildcat 4 miles east of this production and near the west edge of Lewisville townsite in SW NW 16-16-24.



When you standardize on Le Roi, you get greater satisfaction and lower operating costs. Sizes range from 4 to 400 h.p., operating on natural gas, butane, or gasoline.

LE ROI COMPANY
Milwaukee 14, Wisconsin

NEW YORK • WASHINGTON • BIRMINGHAM • TULSA • SAN FRANCISCO

See your nearest Le Roi Distributor

Oklahoma
Le Roi Company Branch — Tulsa
Carson Machine & Supply Co. — Oklahoma City

East & South Texas, Gulf Coast
Southern Engine & Pump Co. — Houston, Kilgore, Edinburg, Dallas, San Antonio, Texas, and Lafayette, Louisiana

North & West Texas, New Mexico
General Machine & Supply Co. — Wichita Falls, Odessa, Lubbock, Texas

Kansas
Carson Machine & Supply Co. — Great Bend

Illinois-Missouri
Western Machinery Company — Centralia, Illinois and St. Louis, Missouri

Michigan
Hafer Engine Service — Reed City

Rocky Mountain Area
Industrial Power Units, Inc.—Casper, Wyoming

Northern Louisiana & Mississippi
Ingersoll Corporation—Shreveport, Louisiana, and Jackson, Mississippi

West Coast
Le Roi-Rix Machinery Co.—Los Angeles, Calif.

Western Pennsylvania—Western New York
Lloyd, Smith Company — Bradford, Penn.

Canada
Drilling Supplies Ltd. — Calgary, Alberta

Complete Sales and Service Facilities

LE ROI MILWAUKEE

P-68

The New— BOWSER ESTABLISHED 1885

GAS TRAP ... for OIL WELLS

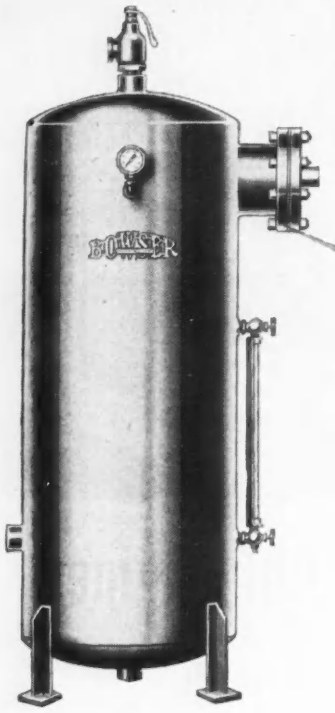
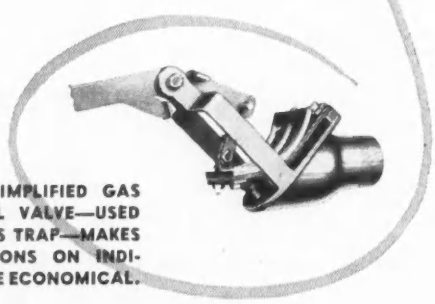


FIG. 426 GAS TRAP

WITH NEW..SIMPLIFIED GAS AND OIL CONTROL VALVE...

- Eliminates Crude Spill-over into Gas Line
- No Packing Glands
- Operates on Vacuum or Pressure
- No Metal-to-Metal Seats
- No Grinding or Reseating
- Positive Action
- Nothing to Get Out of Order



THIS PATENTED, SIMPLIFIED GAS AND OIL CONTROL VALVE—USED IN THE FIG. 426 GAS TRAP—MAKES METER INSTALLATIONS ON INDIVIDUAL WELLS MORE ECONOMICAL.

The new Bowser Fig. 426 Gas Trap efficiently separates gas from oil in individual well installations or as a central unit for small lease operations.

It is an important part of the complete Bowser Automatic Well-Check System when combined with the Bowser Proportional Sampler and Special Oil Well Meter.

Write today for complete details on the new Bowser Gas Trap.

BOWSER, INC., 1355 Creighton Avenue, Fort Wayne 2, Indiana

LIQUID CONTROL SPECIALISTS SINCE 1885

☆ Mississippi

Wayne County Wildcat Given Encouragement in Eutaw

Wayne County wildcat tests encouraging shows; LaGrange field in Adams County due for further exploration.

Wayne County: Humble Oil and Refining Company's E. L. West 1, 18-9n-7w, 6 miles east of the Eucutta field, is showing possibilities with the recovery of shows from the Eutaw horizon. The well was drilled to 8500 feet, but with no encouragement from the lower horizons, was plugged back to 4999 feet where shows had previously been reported, and production string of 5½-inch casing was set. A drill-stem test at 4944-70 feet had good blow, but swabbed only fresh water. Tests continued.

Adams County: Sohio Petroleum Company and Roeser & Pendleton's Baker-Beach 1, 34-6n-2w, is digging pits and moving in pipe for a third test of the LaGrange field. Location is south of the Baker-Maier 1, discovery well for the field, originally completed in the Massive sand zone. The Baker-Maier, however, had a very heavy input of salt water from the zone so it was recently plugged back and successfully recompleted in the Wilcox sand at 6216-20 feet. It is now producing at the rate of 60 barrels of 36-gravity oil per day through ¼-inch tubing choke.

Forrest County: The Superior Oil Company's Cassie Bradford 1, 1-3n-13w, deep wildcat, is working below 13,700 feet with further production tests in prospect. Late in July production string was set to 12,126 feet and unofficial reports had it that shows of gas-distillate were encountered at 12,014-045 feet and shows of oil in sand at 12,305 feet.

Jasper County: Gulf Refining Company's J. B. Ruffin 1, SW SE NW 27-10n-13w, seems assured as a second gas well for the Soso field with the report of 18 feet of gas in cores at 6494-6624 feet. Production string has been set to 6698 feet.

Clarke County: L. J. Rousell & Joe W. Brown Trustee's Long Bell Petroleum Company 2, C NE SW SW 10-2n-16w, has given indications of making a small producer for the Quitman field after tests of section between 3658-62 feet recovered some oil with salt water. Testing continues.

Grenada County: J. K. Lockhart's Guy Fite 1, 25-22n-6e, rank wildcat, is shut down for orders after reaching 3943 feet. A drill-stem test at 2697-2731 feet recovered only fresh water and cores from 3665-85 feet recovered dark gray sandy shale with no shows indicated.

Mississippi Request Denied

The Mississippi State Oil and Gas Board denied the request of several operators for a top allowable limited to 75 barrels daily in the Heidelberg field of Jasper County, and also the application for 640-acre spacing in the Gwinville gas field of Jeff Davis County rather than the 320-acre spacing that now exists. Several hearings were heard on the Heidelberg ruling, but the Board confined itself to the decision that in order to prevent physical waste and protect the oil field, no operator should take from his well or wells an unreasonable amount of oil daily.

☆ California

Gardena Strike Flowing 1040 Barrels; New Location Staked

Gardena discovery flowing 1040 barrels from schist conglomerate as location staked for second well; Six Companies decide on additional drilling in new field near El Segundo; fourth well completed in East Los Angeles flowing 514 barrels with strong gas pressure; deep test in Huntington Beach field testing showings; 4 new wells scheduled for old Edna field in San Luis Obispo County; Kern County deep test nearing 14,000 feet.

Los Angeles County: Completion of Bodger 1 in the Gardena area by British-American Oil Producing Company and The Texas Company, as indicated here last week, is a major oil discovery. The well is currently flowing 1040 barrels of 26-gravity oil, 0.2 per cent cut, and 750,000 cubic feet of gas through 22/64-inch choke. Flow pressure is 1200 pounds. Location is in 22-3s-14w, south side of Los Angeles.

Total depth is 9154 feet. Eighty-eight feet of 5½-inch pipe, including 70 feet of perforated, was landed at 9153 feet and 2½-inch tubing at 9066 feet. Production is from the schist conglomerate, which is also productive in the El Segundo field and the new field recently discovered between El Segundo and the Los Angeles airport.

Six Companies' recent discovery on the southwest edge of Los Angeles near El Segundo, Fee 1 in 2-3s-15w, continues to flow about 105 barrels through 1-inch choke. Operators involved in this development are Shell Oil Company, Standard Oil Company of California, Texas Company, Tide Water Associated Oil Company, Richfield Oil Corporation and Union Oil Company. Decision has been reached by the group to drill a second well in the area and Standard, it is reported, will act as operator. Location has not been divulged.

Richfield has completed its fourth well in the East Los Angeles field. Edison 1 in 16-2s-12w is flowing 514 barrels of 39-gravity oil, 13 percent cut, and 2,025,000 cubic feet of gas through 21/64-inch choke; flow pressure, 1540 pounds.

Orange County: Southern Belle Oil Company's deep test in the town-lot area of the Huntington Beach field, Rex 12 in 2-6s-11w, is testing up-hole showings before perforating and testing lower zones. Total redrilled depth is 7895 feet with showings reported from 6700 feet. Deepest test ever drilled at Huntington Beach went to 9050 feet in lower Miocene without results.

San Luis Obispo County: Dolly Adams Oil Company will drill 4 wells in the old Edna field in 31-31s-13e. There are a few old shallow producers of 14-gravity oil in the field, which was discovered about 1906.

Kern County: There was no change in the status of Kern County's deep tests the past week. Pacific Western Oil Corporation's National Royalties 1 in 5-26s-22e is spot coring below 13,900 feet and field gossip is that the well is headed for a new world's depth record. Belridge Oil Company's South Belridge field deep test, 62-W-33 is making hole below 13,500 feet.

Oil men have asked for it

Not since 1942 has it been possible to offer you complete, factual information about this Coast area where more wells are drilled over 10,000 feet deep than in the rest of the world combined.

Don't miss this big, special edition.

GULF COAST ISSUE of The Oil Weekly

Yes, you can now see for yourself the effect of wartime trends and developments in this coastal region of Texas and Louisiana. Thumbnail sketches highlight developments, formations, depths, production, reserves. A big four-color map shows the location of all Gulf Coast oil, gas, and condensate fields.

Although the single copy price of the Gulf Coast edition is $1, that issue is included in subscriptions to The OIL WEEKLY. If you are not a subscriber, use the coupon.

Watch for it ....September 16

TELL A FRIEND ABOUT IT.

Send me The Oil Weekly

Here's my check for ☐ 3 years for $4; ☐ 2 years for $3; ☐ 1 year for $2.

Name _____ Position _____

Company _____

Street and No. _____

City and State _____

Check Branch of Industry ☐ Drilling Contractor ☐ Producing Company ☐ Pipe Line ☐ Manufacturer ☐ Individual Producer ☐ Service ☐ Supply

Mail to Box 2608, Houston, Texas. Only ACTIVE OIL MEN may subscribe.

☆ Rocky Mountain Area

Fremont County, Wyoming, Test Completed in Tensleep

Fremont County, Wyoming, test being completed in Tensleep; Natrona County prospect abandoned; Church Buttes test staked; California stakes Powers County test.

Wyoming

Sinclair Wyoming Oil Company is preparing to complete Unit 3, SE SE SE 10-32n-95w, Sand Draw field, Fremont County, in the Tensleep sand, after thorough testing of the Embar (Phosphoria) section. This well produced at the rate of 434 barrels of 57-gravity distillate with 15 million cubic feet of gas per day against 50 pounds separator pressure through perforations between 7060-7100 and 6686-6735 feet. This formation had good shows in the other 2 wells in the field but had not previously been tested. The well blew out 2 months ago in the upper Embar at 6645 feet, total depth, and made an estimated 25 million cubic feet of gas but was brought under control and drilling continued to the Tensleep. The well is ½ mile north of the discovery, and ran approximately 100 feet higher on the Tensleep horizon. Tensleep was topped at 7116 feet and 7-inch casing set on that sand. Perforations have now been squeezed off and the well will be drilled into the Tensleep.

Natrona County: At Castle Creek, British American Oil Producing Company's wildcat, Government-Davis 2, SW NW NE 24-38n-81w, has been abandoned after making only 5 percent oil with 24 barrels of fluid on test of the third Frontier topped at 2261 feet. The well was only 7 feet in the sand with a total depth of 2268 feet. Officials of the company have not announced whether another test will be made of this 10,000-acre unitized block.

Uinta County: Mountain Fuel Supply Company of Rock Springs, which in April completed the deepest producing well in the Rocky Mountain region at Unit 1, C SW NW 8-16n-112w, Church Buttes area, has made location for its third test of this structure. The new location is Unit 3, SW NE SW 12-16n-113w, 2 miles west of the discovery, and 6 miles southwest of the second test, now drilling below 4100 feet. Unit 1 was completed for an estimated 500 barrels per day of distillate with gas from Dakota at 12,500-12,609 feet, but has been shut in pending completion of the second and third wells.

Colorado

The California Company has located a wildcat on its Wiley Block at Luster 1, C SE NE 10-22s-47w, Prowers County, 5 miles northwest of Lamar. The California block is approximately 30,000 acres and Kerr-McGee have been given contract to start immediately on a test to around 5800 feet. This is the third wildcat to be started this year on the northwest flank of the Anadarko Basin in Colorado, and follows an extensive lease and geophysical play throughout the area. In July, Union Oil Company of California abandoned its test in the Eads area, 17-17s-48W, Kiowa County, at 5755 feet, total depth, in the Arbuckle. Fifty miles southeast of the new location Sharples Corporation of Denver is drilling a test of the Freezout Creek area at Murray 1, SW SW SE 26-29s-50w, below 2000 feet. Drilling of both these wells is based on the possibility of stratigraphic traps in lower formations against the Las Animas Arch of south-central Colorado. At least 1 million acres are under lease in this area to various major and independent operators.

AIME Session Set

"Multiple Stage Cementing" will be the subject of a talk by William D. Owsley, chief engineer for Halliburton Oil Well Cementing Company, at the September 10 meeting of the Gulf Coast Section AIME at 6:30 p.m. in the Texas State Hotel, Houston.

DAVE SANDLIN J. D. SANDLIN

SANDLIN BROS.

Drilling Contractors

HEAVY POWER RIGS

FOR WELL SERVICE

HEAVY STEAM RIGS

FOR CONTRACT DRILLING

New Iberia, La.

P. O. BOX 523 — PHONE 1212

Houston Office: 912 Southern Standard Bldg., Phone C 4-3982

☆ Michigan

Deep River Field Southeast Extension Tries Disappoint

Blocking of new southeast extension of the Deep River field, Arenac County, second largest flush area in the state, looms as 2 key tests drilled the top dolomite section without logging probable commercial oil pays.

Rowmor and Major's Nott 2, NW SE NW 24-19n-4e, logged Dundee dolomite at 2765 feet, 13 feet low, and at 2815 feet had not picked up a pay. First 14 feet of the dolomite is the average completion depth for the field and 35 feet below the top is considered the maximum for commercial production. Test is 660 feet east of a 115-barrel per hour top pay well and lies directly on the southeast trend that has produced over a 5-mile long strip.

Further adding to the probability of a closeoff of the prolific pool, Joe E. Bauer's Pittel 1, SW SW NE 24-19n-4e, ¼ mile due southeast of the Nott 2, logged Dundee at 2760 feet and had not showed 20 feet in the section.

Closeoff of the field will be a serious blow to Michigan development, as this area has offered the only important field development for new production in the state.

Isabella County: Roosevelt Oil Company's Gibson 1, W½ SW NW 12-14n-3w, deep test in the old Mt. Pleasant field, developed in 1929-31 for 3500-3600-foot Dundee lime oil production, carried water at 4125 feet and at 4462-73 feet, 2 points in the Monroe regarded as potential oil zones. Casing will be reset to test into the Sylvania around 4800 feet. Small show of sulphur oil was logged at 4233 feet.

☆ Ohio

Brush Creek Test Makes Gas; Western Penfield Adds Well

Brush Creek well makes gas in Clinton; Western Penfield adds large well; Gas extension at West Salem-Burbank; Bearfield has second south extension.

Muskingum County: Atha Realty Company's C. S. Sherman 6, SW NW 17, Harrison Township, 1 mile north of Gaysport, reached the Clinton sand at 4298 feet and at 10 feet in gauged an estimated 5 million cubic feet of gas. The well is shut down for testing.

Lorain County: Ohio Fuel Gas Company's Walter Kobosiuk 1, Lot 5, Penfield Township, had an open flow of 4¼ million cubic feet in the Upper Clinton horizon. The sand, thinning to the north, was logged at 2391-2401 feet.

Wayne County: Ohio Fuel moved 1 mile east of an old field near Burbank to complete Cleveland Trust Company 1, NW SW 3, Congress Township. Clinton, at 2910-36 feet, had an open flow of 650,000 cubic feet natural, which was shot and shut in at 1½ million.

Perry County: B. G. Davis' Murray Penrod 1, NW NW 27, Bearfield Township, ½ mile south extension, had a gauge of 1,100,000 cubic feet in the Medina sand, 3956-61 feet. This is the largest open flow yet completed in the pool.

CALIFORNIA WILDCATS

Solano County—Failures: Amerada's Church 3, 1-4n-2e, Cache Slough area, abnd 6200.

Fresno County — Failure: Bankline Oil Co.'s Kenyon 1, 4-17s-15e, Cantua Creek area, abnd 6675.

Orange County—Failures: R. W. Jerman's Gothard 1, 27-5s-11w, Huntington Beach area, abnd 6370.

G. D. Murdock's Howell 1, 1-4s-9w, Kraemer area, abnd 4508.

Santa Barbara County—Failures: Barnsdall-Honolulu Oil Corp.'s Petan 1, 5-5n-32w, Gaviota area, abnd 4986.

Ohio Oil Co.'s Prevedello 1, 1-4n-28w, Goleta area, abnd 3266.

Los Angeles County—Oil Discovery: British-American-Texas Co.'s Bodger 1, 22-3s-14w, Gardena area, flow 1200 bbls clean, 26-gr oil, 20/64-in, 700,000 gas, tp 1200 lbs, td 9154.

ILLINOIS WILDCATS

Clinton County—Failure: H. Lutrell et al's Garder 1, ne nw nw 21-1n-1w, abnd 1631.

Cumberland County—Failure: Nat. Assoc. Pet.'s Seegers 1, sw sw sw 2-9n-7e, abnd 2490.

Edwards County—Failure: C. P. Chandler et al's Bunting 1, n½ nw se 33-1n-10e, abnd 3435.

Effingham County—Failure: Ben J. Taylor's Schmidt 1, se se sw 28-7n-7e, abnd 2882.

Hamilton County — Failures: Aetna Oil Co.'s Batchelder 1, nw sw nw 5-4s-7e, abnd 3315.

Texas Co.'s Bennett 1, se nw nw 27-5s-5e, abnd 3519.

Jefferson County—Failure: E. J. Reuwaldt's Hynes 1, nw sw nw 28-2s-2e, abnd 2710.

Jersey County—Failure: Nat. Assoc. Pet.'s Stifle 1, nw se ne 6-6n-11w, abnd 3281.

Morgan County—Gas Discovery: L. M. Ladet's Stenemeyer 1, nw nw ne 22-13n-8w, flow 1,700,000 gas fr Pennsylvania sd 250-63, td 265.

White County—Oil Discoveries: Superior's Ford et al 27, nw sw ne 8-5s-14w, flow 400 bbls fr McClosky 2949-51, td 3007.

Oil Management et al's Williamson et al 1, nw ne sw 14-7s-9e, flow 108 bbls fr Aux Vases 3863-82, td 2882.

INDIANA WILDCAT

Sullivan County—Failure: G. W. Gambill's Liston 1, 7-8n-8w, abnd 571.

KANSAS WILDCATS

Pawnee County — Failure: J. M. Huber Corp.'s Smith 1, nw nw nw 22-20s-16w, abnd 3832.

Rice County—Failure: Phil-Han's Shonyo 1, nw nw se 10-18s-10w, abnd 3299.

Woodson County—Failure: R. L. Brineager et al's Bauersfeldt 1, sw ne sw 35-25s-14e, abnd 1500.

KENTUCKY WILDCATS

Breckinridge County—Failure: Texas Co.'s Whalen Estate 1, 21-Q-41, abnd 1985.

Butler County — Oil Discovery: Frank Bernier's Barbee 1, 17-I-32, pump 5 bbls fr Pennsylvania sd 382-98, td 401.

Henderson County—Oil Discovery: Carter's Powell 1, 20-0-23, flow 286 bbls fr O'Hara, 2463-70, td 2705.

Henderson County—Failures: Sinclair Prairie's McDonald 1, 12-P-20, abnd 2750.

Thorne Drlg. Co.'s Crafton 1, 16-Q-25, abnd 2495.

Muhlenberg County—Failure: Texas Co.'s Rogers 1, 10-I-29, abnd 2176.

NORTH LOUISIANA WILDCATS

Madison Parish — Failure: Murphy-Sun's Lylah E. Clark 1, 649 fr nl 1969 fr el 17-17n-12e, Tuscaloosa 3764, Paluxy 3838, Glenrose 5397, lime stringer 5533-40, Massive Anhy 5745, abnd 5810.

Richland Parish—Failure: Homer Hurley & Demopulos' Singer Mfg. Co. 1, c nw nw 21-18n-9e, Comanche 2895, abnd 4013.

MICHIGAN WILDCATS

Bay County—Failure: Ervin Major's Flies 1, se se ne 16-17n-4e, abnd 3190.

Isabella County—Failures: Eddie H. Bell's Bates 1, sw nw sw 12-13n-3w, abnd 1515.

Union Drlg. & Prod. Co.'s Hall 1, ne nw nw 14-3n-5w, abnd 3715.

Mason County—Failure: Superior's Barothy 1, se ne sw 22-17n-16w, abnd 3143.

Osceola County—Failure: Sun's Salisbury 1, c sw 10-20n-7w, abnd 1478.

MISSISSIPPI WILDCAT

Lincoln County—Failure: Roeser & Pendleton's Columbus Lbr. Co.'s 1, ne nw 20-6n-6e, Wilcox 4046, Eutaw 9662, Tuscaloosa 10,230, Massive sd 10,620, Comanche 10,683, abnd 10,706.

NEW MEXICO WILDCATS

Eddy County—Failure: R. F. Momsen et al's State 1, sw sw ne 36-19s-28e, elev 3296, salt 345, abnd 1447.

Lea County—Failure: Union Oil Co.'s State 1-B, c nw sw 3-21s-34e, elev 3705, anhy 1893, base salt 3447, Yates 3852, abnd 4017.

OKLAHOMA WILDCATS

Carter County—Failure: Loual Drlg. Co.'s Champion 1, ne ne nw 25-4s-2e, abnd 3502.

Cotton County—Failures: J. Ben Russell's Compton 1, sw sw sw 2-4s-10w, abnd 2011.

Hurk Royalty Co.'s Warren 1, sw sw sw 3-5s-10w, abnd 1884.

WEST CENTRAL TEXAS WILDCATS

Brown County—Failure: Mesa Drlg. Co.'s Schultz 1, 450 nsl 4800 ewl of Samuel Bangs sur 108, Adams Branch 530, Fry 1025, abnd 1340.

Callahan County—Failures: Dean Bros. et al's Isenhower 1, 1155 out sec sect 9, Bayland Orphan Home sur, abnd 577.

Chas. E. Timm et al's Wiley 1, 800 snl 150 ewl TE&L Co. sect 2975, abnd 633.

Jones County—Oil Discovery: V. E. Autry-M. M. Garrett et al's Minter 1, 710 snl 330 wel S.P. Ry. 39, blk 2, 4¼ mi sw Neianda pool, nearest, elev 1906, Noodle Creek 2710, base Saddle Creek 2929, Gunsight 3358, Swastika 3439, flow 288 bbls 43-gr, gor 600/1, natural via 5/16-in fr Swastika perf 3439-43, td 3450.

Mills County—Failure: Ray Pool Drlg. Co.'s Hines 1, 990 wel 330 nsl sect 1, BBB&C Ry. sur, Marble Falls 1140, Ellenburger 1489, abnd 1521.

Shackelford County—Oil Discovery: Hickok & Reynolds' J. P. Morris 1-C, 220 out nwc E.T. Ry. sect 198, pump 41 bbls 35-gr fr sand 1569-74.

Taylor County—Oil Discovery: Carl Hovgard et al's Campbell 1, sw sw ne T&P Ry. 6, blk 18, 3-1/16 mi nw Murphree pool, elev 1944, Noodle Creek 2460, pump 5 bbls oil, 5 bbls wtr, 3000 gals acid Noodle Creek perf 2490-2503, td 3202, pb 2503.

WEST CENTRAL TEXAS OUTPOST

Jones County—Neianda Failure: H. W. Snowden O&G Co.'s Poe 1, 467 out swc ne¼ labor 1, Lge 358, Goliad CSL sur, 1-1/16 mi e of prod, elev 1804, coal 2839-42, abnd 2854.

NORTH TEXAS WILDCATS

Baylor County—Failure: Fain & Riner's Fritz 1, ne nw nw H&TC Ry. 46, blk 45, elev 1383, abnd 1847.

Clay County—Failures: Gus Blakely et al's Engle-Gulf 1, 150 snl 2220 ewl M. B. Skerrett sur, abnd 765.

Sussex Oil Co.'s Henderson 1, 2020 nsl 1125 wel D. F. Brannon sur, abnd 1144.

Continental's Crump 1, 990 snl 330 wel blk 45, Grayson CSL sur, elev 1009, Bend 5701, Barnett 6000, Mississippi 6069, Simpson 6166, Ellenburger 6190, abnd 6315.

Cooke County—Failures: E. L. Gill et al's Enderly 1, 150 out sec J. E. Selkirk sur, Ellenburger 1942, abnd 2252.

Shell's Wooldridge Lumber Co. 1, 330 wel 990 nsl W. Wilburn sur, elev 873, Bruhlmyer sd 2190, Ellenburger 4425, abnd 4533.

Baylor County—Failures: W. F. Palmer et al's Jordan 1, 3470 nsl 1320 ewl sect 150, T&NO Ry. sur, abnd 1377.

Scott Bros. et al's Robertson CSL 1, 4290 out nwc Robertson CSL sur, elev 1204, abnd 3138.

Cooke County—Failures: J. B. Heinen Jr. et al's Barnes 1, 330 ewl 1799 snl of John Gregg sur, Ellenburger 1770, abnd 1782.

Sinclair Prairie's Dawson 1, 1323 snl 990 ewl sect 93, Fannin CSL sur, elev 819, Strawn sands 5754, 5859-69, Simpson 6024, abnd 6065.

Haskell County—Failure: T. D. Humphrey's Norton 1, 330 wel 990 snl lot 44, James Scott sur, elev 1513, Palo Pinto 3651, abnd 3740.

Montague County—Failure: Honolulu Oil Corp.'s Price 1, 317 s 2310 w swc John Short sur, but in Francis Escobar sur, elev 841, lime 4705, abnd in granite 5140.

Young County—Failure: L. T. Burns et al's Ernest 1, 1650 nsl, 450 ewl sect 64, TE&L Co. sur, abnd 1120.

EAST TEXAS WILDCATS

Houston County—Failure: Humble's LeGory 1, 50 ne of sw 2257 se of nw of Francis Hill sur, elev 385, Navarro chalk 5800, Pecan chalk 6067-6573, Austin chalk 6973-7272, Woodbine 7317, abnd 7539 in Basal Woodbine.

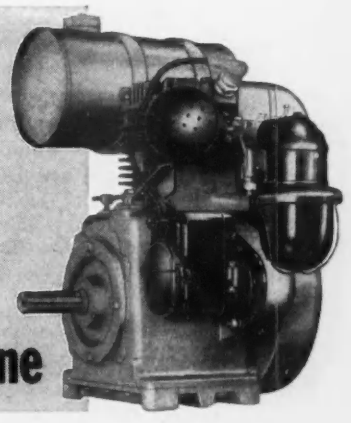
Navarro County—Failure: Coffield & Guthrie's Mays 1, 330 fr sw 1250 snl of 132-ac tr, John McNeal sur, elev 333, Wolfe City 1425, Austin chalk 1824, abnd in chalk 1942.

You Get

HEAVY-DUTY SERVICEABILITY in a Small Engine

WHEN YOU SPECIFY

WISCONSIN *Air-Cooled* Engine



In designing power-operated equipment within a 2 to 4 hp. range . . . one of the vitally important considerations is to secure a power unit that can be depended upon for *heavy-duty serviceability.*

This is one of the predominant characteristics of the little Models AB and AK Wisconsin Air-Cooled Engines. Every detail of design and construction . . . from the Timken tapered roller bearing mounting of the crankshaft front and rear, to the mirror-honed cylinder . . . has been engineered for heavy-duty operation under rugged conditions. These engines are equipped with rotary type outside magneto impulse coupling, assuring quick, easy starting in any weather, at any season.

Write for detailed specifications and other pertinent data. Wisconsin Air-Cooled Engines are available in 4-cycle single cylinder and V-type 4-cylinder models in a complete power range.

WISCONSIN MOTOR Corporation.
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
510 Atlas Building, Tulsa, Oklahoma
M & M Building, Houston, Texas
Oil field distributors for Wisconsin Engines and all types of utility units.

The OIL WEEKLY'S TRADING POST

USED EQUIPMENT FORUM

CLASSIFIED ADS . . . EQUIPMENT . . . SERVICES . . . PERSONNEL

FOR SALE

■ 5 Complete Reda Pumping Units. Cables like new. 75 and 97 H.P. Motors. Max Steinbuchel, 1905 Park Place, Wichita 4, Kansas. Phone 5-6082.

■ FOR SALE—831'2" of new A.P.I. casing, 11¾" O.D. 47# seamless steel, Grade J-55, Short T & C, 8 round thread. 34 Pieces 771 Ft. of Range 1, 2 Pieces 60'2" Range 2. Pittsburgh Plate Glass Company, New Martinsville, West Virginia. Purchasing Agent.

FOR SALE

50— 500 Barrels
10— 1,000 Barrels
20— 5,000 Barrels
4—10,000 Barrels

Heavy A.P.I. New closed bolted type steel tanks now located at Ogden, Utah. Can quote reasonable prices in order to move from present premises at once.

JOS. GREENSPON'S SONS PIPE CORP.
National Stock Yards, St. Clair County, Ill.

OIL FIELD EQUIPMENT SALESMAN

Unusual opportunity for salesman capable of promoting foreign sales for internationally known manufacturing concern. Thorough knowledge of oil field equipment and drilling operations, together with previous sales experience essential. Must be free to travel throughout all producing world. Furnish complete outline of oil field and sales experience, education, former employers and salaries received. Also state age and marital status.

Address: Box 62, c/o The Oil Weekly, Houston, Texas.

■ A Gravimeter in perfect mechanical condition with all attachments for car or truck. Box 61, c/o The Oil Weekly, Houston, Texas.

■ WEST CENTRAL TEXAS. Have 183 acres 3600 feet East of New Ellenburger oilfield. Depth 4300 feet, large wells. Consider making deal to responsible party for a well, few legal matters must be cleared up, possibilities great. R. L. Rush, 512 Washington, Waco, Texas.

■ Hotel for sale in West Texas oil field. Fifty rooms, furnished, immediate possession. Fifteen Thousand. Needs interior finish. M. Guyton, Putnam, Texas.

SITUATION WANTED

Public Relations Director of large university wishes to establish and direct division of public and employee relations for large oil company contemplating such a program. Box 64, c/o Oil Weekly, Houston, Texas.

FOR SALE

FOR SALE!

Excellent Industrial Property on Busiest Highway in West Texas. Also Industrial Property on Existing Railroad Siding.

F. M. Reeves & Sons Inc.

ODESSA, TEXAS

Phone 2292 Box 929

SITUATION WANTED

■ WANTED—To learn the gravimeter business in Rocky Mts. and Southwest. In exchange can offer ten years geological and engineering experience, last three years surface and sub-surface work in Rocky Mts. area with supervisor responsibilities. Box 55, c/o Oil Weekly, Houston, Texas.

■ Ex-Army major, pilot, BA and MS degrees in Geology, 2½ years geological experience, age 30, married, 2300 hours pilot time accident free. Instrument rating, commercial, single and multi-engine land. Checked out in B-17, B-25, C-45, C-46, C-47, A-20, L-4B, L-5, C-61, PT-17, PT-22 and AT-6. Transport and ATC experience six months. Completed probation with and presently employed by major airline. Desire connection with oil or tool company combination sales-geology-piloting. Domestic or foreign. Minimum starting salary $6000 yearly. Box 66, c/o The Oil Weekly, Houston, Texas.

■ PETROLEUM ENGINEER—B. S. in production engineering; seven years experience flush and stripper production practices; reservoir evaluation; core analysis and interpretation; technical report writing; secondary-recovery project installations and operations. Desired location: Tulsa. Box 63, c/o The Oil Weekly, Houston, Texas.

HELP WANTED

■ ENGINEERS WANTED—Major oil company desires several engineers, with bachelor of science degree and minimum of three years experience in petroleum production. Attractive future. State qualifications fully. Box 65, c/o The Oil Weekly, Houston, Texas.

■ DISTRICT GEOLOGIST, EASTERN VENEZUELA—College graduate in geology, 8 to 10 years experience, preferably several years supervising Geologic aspects of Wildcat and Field development wells. Foreign experience and Spanish desirable. Housing and educational facilities available for family. Write to: The Atlantic Refining Co., Rm. 900, Box 7258, Phila. 1, Pa.

HELP WANTED

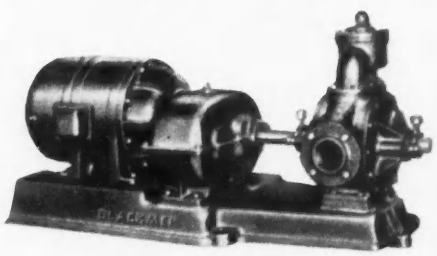
DRAFTSMEN

DESIGNERS AND CHECKERS
with experience on
Structural Steel and Concrete
Process Piping
Pressure Vessels

The Boston office of E. B. Badger and Sons Co., internationally famous chemical engineering organization, offers qualified men well-paying positions. This is a fine opportunity for men who would enjoy working in congenial surroundings and with pleasant cooperative associates. A personal interview can be arranged in your city. This is not a temporary position. Write, giving full details of background and experience, salary wanted, etc., to

Mr. William M. Rose, Personnel Director
E. B. Badger and Sons Co.
75 Pitts Street, Boston, Mass.

BLACKMER ROTARY PUMPS



For gasoline or other volatile fluids. Capacity 285 GPM at various heads, according to motor installed (No motors). 4" suction and discharge. These are government surplus and new. Capacity sheet available and immediate delivery from Houston. Sample on display at 911 Isabella.

Way Engineering Co.

911 ISABELLA HOUSTON 4, TEX.

SOUTH CENTRAL TEXAS WILDCAT

Atascosa County—Failure: Southern Minerals Corp.'s John Lytle Tom et ux 1, 7050 fr sel 467 fr swl 1576-ac lse, 467 fr swl 1770 fr sel W. E. Tom & Bros. sur 2, 6 mi sw Fashing disc, Wilcox 3866, Massive Wilcox 3929, abnd 6505.

Guadalupe County—Failure: United North & South Dev. Co.'s J. F. Webb 2, 380 fr nw&sel 370 fr nel 151.8-ac lse, Jas. Hodges sur, Serpentine 2325, abnd 2612.

Williamson County—Failure: C. L. Brown, Jr.'s, John Holub 1, 330 fr s½wl 74.25-ac lse, Jehu Bevil sur, Pecan Gap 606, abnd 1108.

SOUTHWEST TEXAS WILDCATS

Webb County — Failures: O. W. Killam's Servando Benavides 2, 467 fr nl 1860 fr wl AB&M sur 685 and 320-ac lse, s flk old Carolina-Texas fld, abnd 3072.

Westbrook Oil Corp.'s Mabel Adami 3, 1665 fr wl 2012 fr nl H&GNRR sur 335, 302.94-ac lse, 2½ mi s Adami fld, abnd 1293.

Zapata County—Failure: Progress Pet. Co.'s Avelino & Romana T. Guerra 1, 467 fr sel 467 fr swl 160-ac lse, Bernardo Gutierrez sur, Porc 14, on Humble farmout, abnd 4028.

LOWER TEXAS COAST WILDCATS

Brooks County—Failures: Sullivan & Garnett's T. S. Proctor 1, 467 fr e&sl lot 1, blk 21, Falfurrias Farm & Garden Trs, Los Olmos 7, Loma Blanca Gr, 4090 fr sl 1069-ac lse, abnd 8011.

Humble's Dallas Jt. Stk. Ld. Bank 1-E, 330 fr s½wl 1120-ac "E" lse, BS&F sur 195, 1 mi se E. Peters fld, abnd 3050.

Goliad County—Distillate Discovery: Continental's Gena Heard et al 1, (OWWO) 400 fr el 3000 fr sl Robert Walker sur, 972 e fr wl 1193.5-ac lse, Yegua pay perf 48 shots 5050-68, flow est 9,700,000 gas, 33 bbls 62-gr cond, open, gor 60,000/1, sip 1900, td 9002.

Live Oak County—Failure: Humphries & Hotchkin's George Rowold 1, 330 fr s&el lse, 330 fr el 330 fr sl Bridgett Haughey sur, abnd 1574.

Neuces County—Failure: Renwar Oil Corp.'s Frank Cech 1, 467 fr s&wl 320-ac lse, sect 32, Laureles Farm Tr, abnd 6605.

San Patricio County—Failure: Jones & Morgan's W. E. Runge 1, 330 fr wl 1100 fr nl 78.25-ac lse, lot 25 of sbdn in John Pilan sur, 7500 sw W. Sinton oil prod, 5000 s sw S. Sinton gas prod, abnd 7025.

LOWER TEXAS COAST OUTPOSTS

Brooks County—Rosita Failure: American Republics Corp.'s M. I. Richardson et al 1-B, 467 fr nel 330 fr sel 320-ac lse, sw½ H&GNRR sur 18, ½ mi e prod, abnd 3240.

Jim Wells County—W. Magnolia City Failure: Ralph E. Fair's R. R. Mullen 1, 330 fr sl 990 fr el blk 9, Adams-Staples farm lots, 160-ac lse, P. McDonald sur 208, 1 mi n ne W. Magnolia City disc, abnd 5719.

LOWER TEXAS COAST NEW PAY TEST

Nueces County—N. Minnie Bock Oil Discovery: Louis Crouch's W. L. Parr 2, 1467 fr nl 467 fr wl sect 36, Lopez de Herrera Gr, 239.7-ac lse, pay 5990, perf 46 shots 5994-6004, flow 106.9 bbls 36.2-gr oil, 6½% wtr, 7/64-in, td 6803.

UPPER TEXAS COAST WILDCATS

Chambers County — Failures: Frost & Blanke's Janet McCarthy 1-B, 660 fr s&wl HT&B sur sect 98, 160-ac tr, ¾ mi w of prod, abnd 8763.

Mac Drlg. Co.'s D. J. Cline 1, 660 fr n&el 966-ac lse, Jos. Whitcomb sur, sw Willow Slough fld, abnd 8606.

Ft. Bend County—Failure: Humble's J. Brown Cutbirth 1, 660 fr el 467 fr nl blk 31, Moses Shipman sur, Cochran McClure sbdn, 104.6-ac lse, n side of Arcola's Prospect, 3 mi s Blue Ridge prod, Fresno area, abnd 8500.

Montgomery County — Failure: Wm. S. Thomson's Sam L. Olson 1, 466 fr sl 1400 fr wl 270-ac tr and F. A. B. Wheeler sur, abnd in Cockfield 3550.

UPPER TEXAS COAST NEW PAY TEST

Chambers County—Cedar Point Oil Discovery: Standard of Tex.-Salt Dome Oil Corp.'s State-Galveston Bay 33-M, 2410 fr nw&nel Galveston Bay sect 118, 640-ac lse, pay 3864, perf 80 shots 3867-76, flow 120.86 bbls 27.6-gr, 5/32-in, gor 312/1, tp 190 lbs, td 3880.

WYOMING NEW PAY TEST

Hot Springs County—Madison Oil Discovery: Texas Co.'s State 3, nw ne se 36-43n-91w, Black Mt., Muddy 620, Dakota 930, Lakota 1000, Morrison 1020, Sundance 1240, Embar 3934, Tensleep 3196, Amsden 3265, Madison 3815, Cambrian 4397, perf 24 shots 3865-74, swab 239 bbls fluid, 30% wtr in 8 hrs, td 4997, pb 3936.

WYOMING WILDCAT

Natrona County—Failure: British American's Gov't-Davis 2, sw nw ne 24-38n-81w, Castle Creek, 3rd Frontier 2261, saturated 2261-64, swab 24 bbls fluid per day, 5% oil, abnd.

WILDCAT STARTS

CALIFORNIA

Kern County: Miller and York's Richardson 1, 18-29s-21e, Sheep Springs area, gr.

Pacific Gulf Oil Co.'s Karpe 1, 30-28s-29e, Round Mt. area, lcn.

Texas Co.'s Anderson 2, 20-29s-21e, Sheep Springs area, cellar.

Kings County: Glenn Dial's Kings 1, 13-24s-17e, Pyramid Hills area, lcn.

Orange County: General Exploraton Co.'s Marshburn 1, 23-3s-19w, Yorba Linda area, ru.

M. R. & M. Syndicate 1, 17-6s-10w, Costa Mesa area, lcn.

Signal Pet. Co. of Calif.'s Callens 2, 18-6s-10w, moving in mast.

Ventura County: Bankline Oil Co.'s Black 103, 13-4n-18w, Del Valle area, dr.

F. E. Fairfield's Lemon Co. 1, 23-3n-21w, West Mt. area, bld rig.

Exeter Oil Co., Ltd.'s, Livingston 2, 6-1n-21w, Oxnard area, lcn.

San Mateo County: E. T. Willard's 1, 15-6s-5w, Half Moon Bay area, lcn.

COLORADO

Prowers County: California Co.'s Luster 1, c se ne 10-22s-47w, Wiley area, mim 5800-ft test.

FLORIDA

Franklin County: Pure's Gex-Lewin 3, ne 3-8s-6w, ru.

KANSAS

Ellis County: Doley Oil Co.'s Kippes 1, c w½ se se 20-13s-16w, rur.

Kearny County: Stanolind's Kester 1, 25-21s-36w, drlg.

Marion County: Aladdin Oil Co.'s Weygand 1, se se nw 22-19s-1e, lcn.

Pawnee County: B. & R. Drlg. Co.'s et al's Drake 1, se se ne 19-22s-19w, rur.

Sedgwick County: W. J. Sherry et al's Smith 1, sw sw se 24-26s-1w, cellar.

Seward County: Stanolind's Feathers 1, sw sw ne 15-35s-33w, rur.

Trego County: Mazda Oil Co. et al's Garrett 1, se se ne 16-11s-24w, drlg.

Woodson County: Ruth Lane et al's Campbell 1, se se se 19-26s-15e, mim.

NORTH LOUISIANA

Caddo Parish: N. A. Hendrickson's Muslow Farm 1, 1980 fr wl 1993 fr sl 5-20n-15w, Cotton Valley deep test at Pine Island, lcn.

Madison Parish: Murphy-Sun's Handy McAllister 2, se sw 17-17n-10e, 2 mi ne Delhi, lcn.

Murphy-Sun's Mahoney 1, c nw nw 20-17n-10e, lcn.

Murphy-Sun's O'Neal 1, c sw se 17-17n-10e, lcn.

Richland Parish: Lion Chemical Corp.'s Tensas 1, 1980 fr sl 660 fr wl 22-14n-5e, spud 4500-ft or Paluxy test.

J. A. Humphrey-J. C. Wynne's M. M. McCormick 1, 2310 fr wl 990 fr nl 7-15n-7e, 1 mi sw Mangham, 3800-ft or Paluxy test.

F. L. Bryant Co.'s Thompson 1, sw ne 4-16n-7e, ¾ mi ne Dehlco, lcn.

American Liberty Oil Co.'s Mengel Hudson 26, sw se 4-16n-8e, Tuscaloosa test.

Pan American Prod. Co.'s Geo. Franklin 3, 50 fr nl 330 fr el 34-18n-8e, 4000-ft test.

MICHIGAN

Saginaw County: Henry McEvoy's Hawyard 1, se se sw 35-11n-3e, lcn.

Newaygo County: H. E. Walton's Schuitman 1, se se se 16-13n-14w, dr.

Van Buren County: W. A. Elliott's Schwartz 1, nw ne se 18-1s-16w, dr.

FOR RENT

POWER PUMP

New 5 x FXO Gardner Denver powered with new Waku Motor

JACK KNIFE DERRICK

126 Foot Lee C. Moore

FOR RENT

EARLE ADKISON

Box 814 Houston Fairfax 9339

"Red Wheel"

VALVES, HYDRANTS

Write for Catalog No. 34

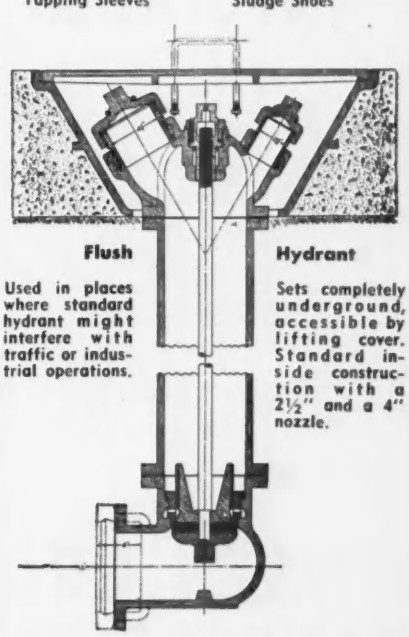
CHECK VALVE

GATE VALVE

M & H valves are used in the oil industry for water, gas, steam, oil, chemicals and are furnished in all commercial sizes from 2" to 30", inclusive. They are cast iron body, bronze mounted, furnished double disc parallel seat or solid wedge. They are heavily proportioned and have a high factor of safety.

OTHER M & H PRODUCTS

Fire Hydrants
Gate Valves
Tapping Valves
Special Castings
Tapping Sleeves
Check Valves
Floor Stands
Extension Stems
Mud Valves
Flap Valves
Sludge Shoes



Flush

Used in places where standard hydrant might interfere with traffic or industrial operations.

Hydrant

Sets completely underground, accessible by lifting cover. Standard inside construction with a 2½" and a 4" nozzle.

M&H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

MISSISSIPPI

Madison County: Magnolia's G. Heindl 1, 21-9n-3e, lcn.

NEW MEXICO

San Miguel County: Waggoner & Wharton's H. D. Upton 1, nw nw nw 25-18n-26e, 10 mi w of Mosquero, 4250-ft test, dr 960.

OKLAHOMA

Cotton County: Wiley-Hood et al's Kirkpatrick's 1, ne ne sw 25-4s-12w, drlg.

Jefferson County: F. D. Johnson's Trout 1, sw nw nw 5-8s-7w, mit.

Lincoln County: L. B. Jackson & Roy L. Kemp's Biles Estate 1, sw sw sw 25-16n-4e, spud.

McClain County: Mid-Continent's Henderson 1, se ne nw 14-5n-2w, rur.

Payne County: Mulberry Oil Co.'s Naumann 1, ne sw se 2-17n-5e, lcn.

Pottawatomie County: Charles F. Balph's Jones 1, ne ne sw 12-11n-6e, lcn.

WEST TEXAS

Ward County: Stanolind's Sealy-Smith 1-B, c ne ne sect 81, blk A, G&MMB&A sur, 2½ mi e by s of prod, 6800-ft Clear Fork test.

WEST CENTRAL TEXAS

Callahan County: Great Lakes Carbon Corp.'s W. E. Smith 1, 340 snl 1260 wel BBB&C Ry. 34, 4900-ft rotary test.

Martin Properties W. N. Foster 1, 330 out nwc Labor 7, lge 337, Victoria CSL sur, 2500-ft rotary test.

Coleman County: L. W. Elliott, Tr's C. L. Eades 1, 2310 wel 2350 nsl of James West sur 276, 2400-ft rotary test.

McCulloch County: W. Glen Weatherford et al's P. S. Pimphrey 1, 2310 ewl 4620 snl of C. Mendell sur 799, 1050-ft cable test.

Runnels County: F. A. Gillespie & Sons' King 1, 4200 wel 1800 nsl of D. Diaz sur 532, 1 mi n of Beddo prod, 3750-ft cable test.

Shackelford County: Woodley Pet. Co.'s Davis 1, 1648 wel 330 nsl of ne T&P Ry. 39, blk 12, 5200-ft cable test.

NORTH TEXAS

Archer County: L. R. Dawson Jr. et al's L. Kinder 1, 1400 nsl 800 wel sect 48, blk 5, Clark-Plumb sur, lcn.

Clay County: Grace & Grace's Bryant Edwards 1, 1263 ewl 330 nsl of n 450 ac of w 950 ac of w 1575 ac of T. M. Hughes sur, 6000-ft Ellenburger test.

Haskell County: R. O. Gould-Calstar Oil Co.'s A. W. Cox 1, 330 out nec sbdn 10, H. O. Campbell sur 110, 3¼ mi sw Lawson field, 3500-ft rotary test.

Montague County: Honolulu Oil Corp.'s S. G. Cooke 1, 1975 snl 1600 ewl J. W. Carter sur, 5000-ft Ellenburger test.

Throckmorton County: Woodley Pet. Co.'s J. T. Odell-Dean Bros. 1, 1877 nsl 660 wel sect 695, TE&L Co. sur, Woodson shallow fld deep test, 5200-ft cable test.

Wichita County: Texas Co.'s Ed. Foster 2, 1025 n 330 w of swc TE&L sect. 831, but in Stephens Dennison sur 832, 3300-ft test, dr 600.

EAST TEXAS

Houston County: John S. Ivy-W. T. Moran's G. L. Murray & Sons 3, start nwc of I. Lopez sur, go s alg wl survey 2575 th w at ra 4850 to lcn in John Durst sur, 1980 n of nl of 25¼ ac tr 1320 wel of 706-ac tr, 10,000-ft Edwards lime test, rur.

Leon County: United N&S Dev. Co.'s R. L. Oden 1, 330 out sec of 73-ac tr, 330 fr sel 1450 fr swl of W. Martin sur 7, 2 mi s Flynn, 8500-ft Edwards lime test.

Limestone County: J. V. Fleming, Tr.'s Mary Ward 1, 400 fr nel 800 fr nwl of 178-ac tr, or 10,700 fr nwl 13,500 fr swl Pedro Varella sur, 8 mi sw Mexia, 3100-ft Woodbine test.

Navarro County: T. N. & R. L. Wheelock-Temple Hargrove's E. V. Smith 1, 330 fr swl 475 fr nwl of 50-ac tr, 330 fr swl 2200 fr sel Jos. Briggs sur, 3400-ft Woodbine test.

SOUTH CENTRAL TEXAS

Edwards County: Shell's J. H. Brown 1, 1985 fr sl 1980 fr el sect 9 LI&AA sur, 424-ac lse, 6000-ft Hickory sd test.

Frio County: Wiegand Bros. J. T. Gilliam 2, 467 fr swl 1853 fr nwl BS&F sur 1, 642-ac lse, 1 mi ne Pearsall fld, 6000-ft test.

Zavala County: Texas Co.'s Geo. W. West 4, 1980 fr nel 660 fr nwl sect 5, TCRR sur, blk 4, 4675-8-ac lse, 4087 e of gas-cond prod Leona Rivers, mi 6000-ft test.

SOUTHWEST TEXAS

Duval County: J. W. Gorman's Farmers Life Ins. Co. 1, 330 fr s&wl SK&K sur 557, 320-ac lse, 3½ mi ne Loma Vista fld, 4000-ft test.

J. W. Gorman et al's Florence D. Lowe 2, 1650 fr nl 2310 fr el AB&M sur 76, 1½ mi e ne Labbe fld, 1¼ mi s se McMullen County gas disc, mi 3500-ft test.

Taylor Ref. Co.'s E. A. Parr 4-A, 447 fr sl 2125 fr el J. Poitevent sur 279, 240-ac "E" lse, ½ mi ne Agua Prieta oil prod, 5000-ft test.

LOWER TEXAS COAST

Gonzales County: K. D. Owen-G. D. Beauchamp's Frank Kunetka 1, 467 fr nl or nel 1320 fr w of nwl J. D. Kirkpatrick sur, 320-ac lse, mir 6700-ft test.

Karnes County: W. E. Kinnear's A. D. Willbern et ux 1, 150 fr swl 2914 fr sel Brooks & Burleson sur 3, 330 fr swl 2914 fr sel 330 fr sely/nwl 256-ac lse, 2 mi e ne Runge fld, ru 7200-ft test.

Live Oak County: Continental's Mrs. Clay West Burns 1-A, 660 fr nw&nel 166-ac lse, 660 fr nwl 1980 fr swl Wesley Sellman sur, 9500-ft test.

Nueces County: L. M. Lockhart's J. W. Porter 1, 467 fr n&wl 100-ac lse and lot 8, Roberts & White sbdn John J. Elliff Tr, nw Agua Dulce prod, ru.

UPPER TEXAS COAST

Ft. Bend County: Roxoil Drlg. Co.-Sam Dunnam's H. L. Schroeder 1, 440 fr sw&sel 60-ac lse which is sw 60-ac of w¼ sect 34 H&TC sur, 2 mi n Needville fld, 6700-ft test.

Harris County: Jack W. Frazier's Houston Deepwater Ld. Co. 1, 3075 s Buffalo Bayou, 3000 fr sl 2358-ac lse, Thos. Earle sur, 9000-ft test.

Fred M. Manning's Union Nat. Bank 1, 65-ac lse, James Mellus sur, sw Dyersdale, drlg 3785.

Sun's Independence Gardens Unit 1-A, 623.4 fr sl 788.5 fr el sect 6, H. H. Goldsby 5-ac tr, blk 1, 36.27-ac unit WCRR sur Fairbanks prod, ru 8500-ft test.

Wharton County: Joseph Hornberger, Jr.'s Bodungen 1, 330 fr n&wl sect 42, 80-ac lse, E. C. Osburn sur, 2 mi w Withers prod, mim 7500-ft test.

WYOMING

Big Horn County: Kerr-McGee-Phillips' Pauley 1, nw nw ne 2-50n-92w, Dry Dome, bldg rd.

Uinta County: Mt. Fuel Supply's Unit 3, sw ne sw 12-16n-113w, Church Buttes, drlg 575.

Tennessee Chart Issued

"Oil and Gas Investigation Preliminary Chart Number Four" by Ray Bentall and Jack B. Collins was recently released by the Tennessee Division of Geology of the Department of Conservation, in cooperation with the U. S. Geological Survey. Approximately 56 by 36 inches in size, and in two sheets, this Chart describes the subsurface stratigraphy and structure of the pre-Trenton Ordovician and Upper Cambian rocks in Central Tennessee. Copies may be obtained from the Tennessee Division of Geology, G-5 State Office Building, Nashville 3, Tennessee, for 50 cents.

What's an Idea Worth to YOU?

Here's an idea worth money to you. Check on Jensen Pumping Units before you buy.

Lots of producers have found this good business. They know Jensen has been making dependable, low operating cost units for 26 years. These units have brought them greater profit on every well.

Don't overlook this suggestion. Before you buy any pumping unit, check on Jensens. Talk to owners or write us. You'll be glad you did.

JENSEN BROTHERS MANUFACTURING CO.

. . . Coffeyville, Kansas, U.S.A. . . .

EXPORT OFFICE: 50 CHURCH STREET, NEW YORK CITY

SQUEAKS from the BULL WHEEL

Man in a Hurry

A drunk stopped beside an excavation and shouted down to the men at the bottom of the pit: "Shay, whatcha doin'?"

"Building a subway."

"How long is it goin' to take to build it?"

"Three years."

"Three years! To 'ell with it. I'll take a taxi."

Life Is Like This

The second-hand clothing dealer was trying to sell a suit which at one time in its life had been exposed to a skunk.

"This is a fine suit. Feel the goods. A perfect fit."

"Yeah, but what's that funny smell?"

"Oh, that's me. Ain't I a stinkin' son-of-a-gun?"

Small Fry

He went on a fishing trip and returned with a wife.

"That's a fine girl you've got," said his friends.

"Yeah, but you should have seen the one that got away."

Easy Way Out

"Sorry to hear about your wife running off with your hired man."

"Oh, that's okay. I was going to fire him, anyway."

This Curious World

Baby care must be learned from the bottom up.

A man will always go to bat for a girl with nice curves.

Said Mama Mosquito: "If you children are good, I'll take you to the nudist camp tonight."

When a woman is jilted, she usually wants some expensive remembrance to forget a man by.

Some people think they are worth a lot of money just because they have it.

An army cook was given a dishonorable discharge because, according to the official report: "He cooks potatoes and peas in the same pot."

Poet's Nook

"If all be right that I do think,
There are five reasons we should drink:
Good wine, a friend, or being dry,
Or lest we should be by and by,
Or any other reason why."

Encore

Little Willie, unafraid,
Monkeyed with a hand grenade;
Mother, at the morgue, complained,
"Willie sure is scatter-brained!"

Tolerance at Last

"I want a suit of underwear for my husband."

"Yes, Ma'am, and do you want the buttons on front or side?"

"It doesn't matter. He's a corpse."

Bigger Demotion

"Who are you?" asked the asylum patient.

"I am the new superintendent."

"Well, it won't take long for them to knock that notion out of you. I was Napoleon when I came here!"

Heaven's for Sake!

The Chinese was trying to catch a train but the porter had mislaid his baggage. Finally, as the train was about to depart, the oriental cut loose in a fury: "Pretty damn seldom where my bag go. She no fly. You no more fit for porter than God's sake. That's all I hope."

The Woman's Way

"I've always had a feeling that I would die young."

"But you didn't did you, darling?"

Anything for a Laugh

"You tried for a year to get a date with that beautiful blonde, and when she finally let you in the house, you stayed only five minutes. How come?"

"Well, as soon as I went in she led me to the sofa and turned the light out. So I left. Nobody can say I can't take a hint!"

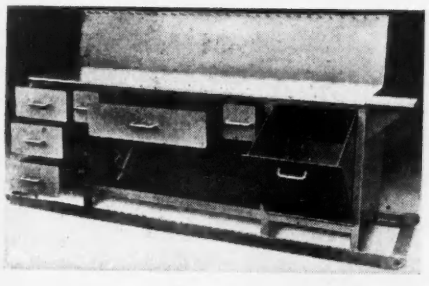
Minor Surgery

"Will this operation be dangerous, Doctor?"

"No operation is dangerous that just costs $40."

OWEN

TYPE "A" WORK BENCHES



REDUCE DRILLING EXPENSES

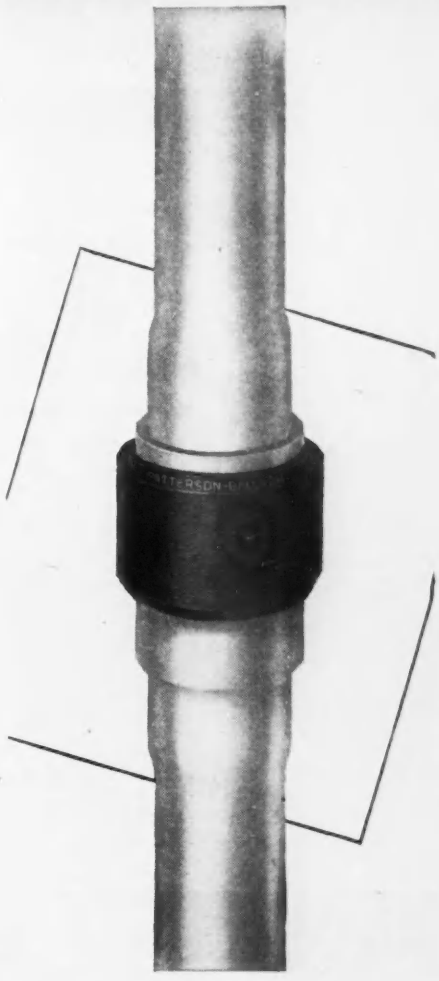
These all-steel, all-welded benches provide a convenient place for all hand tools on the rig. They save drilling dollars by reducing loss and damage of tools and by saving time ordinarily spent in looking for misplaced tools.

Six big drawers and a rag bin provide storage space for all the tools on your rig. Drawers are weatherproof and mounted on rollers for easy operation.

Owen Work Benches are sold through all supply stores and distributed in California by Howard Supply Co. Order one for each rig you operate . . . **they're available for immediate delivery.**

OWEN TOOL COMPANY
ROUTE 9 BOX 800-B / V-2-4341
HOUSTON TEXAS

"Best Bet Yet"



SAVE YOUR TUBING!

Tubing collars worn by contact with casing steal the profit out of pumping. Patterson-Ballagh Plastic Tubing Protectors prevent both collar and casing wear. Oilproof, wear-resistant, insulating. They are cemented to the collar under pressure and will not come off. Made in all sizes. End your tubing troubles. CALL in your Patterson-Ballagh man.

Specify PATTERSON-BALLAGH
A DIVISION OF BYRON JACKSON CO
"Best Bet Yet"

PLASTIC TUBING PROTECTORS

Main office:
1900 E. 65th St., LOS ANGELES 1
6247 Navigation Blvd., HOUSTON 11
92 Liberty St., NEW YORK 6
210 Post St., SAN FRANCISCO 8

MEN IN THE INDUSTRY NEWS

Harold L. Severance, since 1940 attached to the secretary's office of Standard Oil Company of California, has been elected an assistant secretary of the company. Graduating from Stanford University in 1932, Severance went to work for Standard the following year in the Richmond refinery. Subsequently, and until 1940, he served on the accounting staff of the Manufacturing department. His home is in Palo Alto, Calif.

Harold L. Severance

»

F. Wayne Covault, Texas-New Mexico division superintendent for Amerada Petroleum Corporation with headquarters at Fort Worth, has retired after 26 years of consecutive service, which included the drilling of the company's first wells. He will continue to reside at Fort Worth, and will pursue his hobby of raising harness horses.

»

E. E. Steen and **E. A. Steen** have incorporated the Steen Drilling Company, capitalized at $100,000, with headquarters in the West Building, Houston.

Col. E. W. Henderson has been appointed deputy supervisor of the U. S. Geological Survey's Northwestern Division Conservation office at Casper, Wyo. Colonel Henderson was recently placed on inactive status with the Army, and was district engineer with the Survey at Salt Lake City prior to entering the service.

»

S. W. Southerland has been named president of the Anchor Drilling Company, Carmi, Ill., recently organized to engage in general cable tool contracting and producing. Other officers of the firm are **R. E. Fiensy,** vice president, and **H. B. Phillips,** secretary-treasurer.

»

Roy Mays, chief scout of The Pure Oil Company's Fort Worth division, has been transferred to Billings, Mont., where he joined the land department. He will be succeeded in Fort Worth by **Charles R. Evans** of Henderson, Ky.

»

Wallace W. Wilson, engineer with Ryder-Scott Company of Bradford, Pa., has joined California Research Corporation, a subsidiary of Standard Oil Company of California. Wilson, a reservoir engineer and geologist specializing in secondary recovery problems, will be located at the company offices at Santa Fe Springs, Calif.

S. H. Fagadau, consulting petroleum engineer, was elected president of the new North Central Texas Chapter of the Society of Professional Engineers at Wichita Falls, Texas. This is the 12th chapter to be organized in the state. Other officers elected were **A. J. Gates,** vice president, and **Walter Krog,** secretary-treasurer, both of Wichita Falls. Directors are **J. M. Isbell** and **F. M. Rugeley,** Wichita Falls; **H. W. Bartley,** Quanah, Texas; and **L. B. Dean,** Graham, Texas.

S. H. Fagadau

»

Guy E. Chapman and **A. L. Peters,** both of Mount Pleasant, Mich., and **John H. Edahl** of Cisco have incorporated the Chapman Oil Company of Texas. Edahl recently moved to Texas from Mount Pleasant.

»

Leo Bennett and **Gene Bennett,** both of San Antonio, and **Dewey E. Myers** of Indianapolis, have organized the Bennett Bros. Drilling Company, with headquarters in the Alamo National Bank Building, San Antonio.

»

Robert L. Whiting, former associate professor of petroleum engineering at the Missouri School of Mines, recently joined the staff of the petroleum engineering department at Texas A. & M. College as an associate professor. He was instructor of petroleum engineering at the University of Texas before going to Missouri School of Mines in 1945. His experience includes employment with the Sinclair Oil & Refining Company, the Railroad Commission of Texas and Stanolind Oil & Gas Company.

»

Mark Gardner, assistant general superintendent of the production department for Phillips Petroleum Company, Bartlesville, Okla., has become assistant to **H. L. Sullivan,** president and manager of the Loffland Brothers Drilling Company, Tulsa. Gardner was born in Denver and received his education at the Colorado School of Mines. He formerly was employed by Loffland Brothers in 1934 and 1935, but, with the exception of that time, had been with the Phillips company since 1933. He served 3½ years in the Pacific and European theaters during World War I.

Mark Gardner

Model No. 17-S

First Choice Among Oilmen Everywhere Is This Safety-Approved Justrite Flashlight

Best seller in the petroleum industry is this 3-cell Justrite flashlight Model No. 17-S. Powerful beam of 1800 candlepower; 3 cells assure dependable light. Can be used for either spot beam or spread light. Strongly molded plastic case, guaranteed against breakage. Signal flasher switch. Fits in palm of hand, stands on base, or attaches to belt with belt clip. Approved by Underwriters' Laboratories, Inc., and by U. S. Bureau of Mines.

Uses New Honeycomb Lens

Where a larger beam of light is desired, use the famous new Justrite Honeycomb lens—it fits any Justrite Service Flashlight. The Justrite Honeycomb Lens spreads a circle of clear, even light (3 ft. in diameter at 8-foot distance). No dark rings, no distortions.

Honeycomb Lens

Available now! Ask your supply company about Justrite.

JUSTRITE MANUFACTURING COMPANY

2063 N. Southport Avenue, Dept. G-3, Chicago 14, Illinois

MEN IN THE INDUSTRY NEWS

Leroy Newcomb, Emsco Derrick and Equipment Company, has been promoted from assistant chief engineer to chief engineer of the Los Angeles machinery department. Newcomb, a graduate mechanical engineer of the California Institute of Technology, has been closely associated with engineering operations in the petroleum industry for over 15 years. He has been with Emsco since 1936. He will have jurisdiction over all engineering phases of Emsco's oil field drilling equipment manufactured in Los Angeles.

Leroy Newcomb

»

E. L. Dalemont, director of the New York office of Groupement d'Achet des Carburants, Combustibles Liquides, Lubrifants et Derives, a French government oil industry agency, is visiting in Paris, France, and will return to New York this month.

Don Cummins has been appointed quality manager for Cummins Engine Company to serve as final authority on decisions affecting the quality of Cummins engines. He has been with the company since 1919, and for the last five years has been director of research in charge of the experimental and test laboratory. He will have full charge of all inspection departments, and also an intensified program to interpret the user's point of view to every member of the Cummins oranization.

Don Cummins

»

John W. Adelung has been appointed district manager of the White Plains, N. Y., branch office of Mack Trucks, Inc. He resumes his business career after serving with the Office of Defense Transportation as chief examiner, district manager and regional director for New York and New England.

Deaths

Emory H. Smith, 59, with the land department of The California Company, in its Mississippi offices, died in Jackson. A native of Montague, Texas, he lived in Jackson for eight years.

»

James W. Cahill, 56, Dallas independent oil operator, died August 28.

P. M. (Pat) Holden, general manager of stores and retail sales for the George E. Failing Supply Company, was killed in an airplane crash near Enid, Okla., on August 21. He had been connected with the company for 12 years.

P. M. Holden

»

Reginald G. Smith, 57, chairman of the board of directors of American Bitumuls Company, a Standard Oil Company of California subsidiary, died at his home in Ross, Calif., on August 26. He was a native of Australia, and joined Standard as an engineer in the fuel oil division in 1911. At the time of his death, he was also chairman of the board of California Spray - Chemical Corporation, president of International Bitumen Emulsions Corporation, president of Canadian Bitumuls Company, and director of Oronite Chemical Company and California Research Corporation.

»

Ben Wheeler Roberts, 48, general superintendent for **Jerry C. Hawkins,** West Texas producer and drilling contractor, was killed August 28 in an auto accident near Midland. **R. L. Waller,** Fort Worth division sales manager of The National Supply Company, and **Hugh A. Cruder,** Midland district manager for National, were injured.

NEED NEW
BOOMERS
for your
OIL FIELD HAULING?
You can get them now! Norton Type "B" and Type "J" drop forged, heat treated steel Lead Binders (Boomers) are ready for immediate delivery. Order them through your jobber.
NORTON
EQUIPMENT CO., Inc.
Box 1185
Houston 1, Texas
TYPE "B" — Over 30,000 pounds test — for chain sizes up to 5/8 inch.
Guaranteed against failure under normal usage.

PAGES 3079 THRU 3098 IN THE COMPOSITE CATALOG

FRED M. LINK
Preferred
FM Radio
Communications Equipment
Solve your tough communications problems by using this equipment. Proved during war and doubly preferred by Communications men in all branches of the oil industry.
Ask for FRANK CONWELL, Engineer
Houston Radio Supply Co., Inc.
Clay at La Branch Phone C-9009
HOUSTON, TEXAS

WELGEL
TOP QUALITY COLLOIDAL
BENTONITE
Buying WELGEL, you are getting not only the best bentonite, but also security for dependability and prompt delivery service.
Distributor
MUDRITE CHEMICALS
P. O. Box 1013
Houston 1, Texas

Texas Petroleum Industry

The seventh edition of "Important Facts About Texas Oil and Gas" has been published by Texas Mid-Continent Oil and Gas Association, Dallas.

The 44-page booklet contains a roundup of recent development in the state, estimates on reserves, a history of Texas drilling, pipeline, refining and tax information, other data, as well as many tables and charts.

Factual data is presented with the use of official figures for 1945.

Fred W. Shield of San Antonio, president of the association, says in a foreword to the booklet that it "represents the most complete and comprehensive compilation of information on the Texas petroleum industry ever published."

DAN L. CLARK W. M. AVERILL RUPERT COX

DAN L. CLARK
DRILLING CO.

Drillers of

OIL AND GAS WELLS

•

POWER AND STEAM RIGS

NIXON BUILDING

CORPUS CHRISTI, TEXAS

Local 7746-7747 Long Distance 95

PIPE

We Handle All Sizes of Casing or Pipe Suitable for Oil, Gas or Water Wells

• NEW *and* USED •

Call Us for Further Information

YORK SUPPLY COMPANY

HOUSTON • W-68301

YORK SUPPLY COMPANY

BRANCHES:
LAKE CHARLES
BEAUMONT
TYLER
WINNSBORO
MAGNOLIA, ARK.
HAWKINS

Paraffin Salvage

Processes developed in Bureau of Mines laboratories and used successfully in a field pilot plant near Eldorado, Kansas, prove that oil containing as high as 17 percent microcrystalline wax, or paraffin of a high melting point, has been salvaged from weathered tank bottom settlings, commonly considered waste material in the oil industry. Commercial utilization of this product will mean additional income to refiners and producers since the demand for high-melting point paraffin has increased steadily during the past few years.

Development of the relatively simple Bureau process embodying four main principles for the recovery of a clean wax-bearing oil is described in a new Bureau publication now available for free distribution.

The Bureau research, conducted in cooperation with the Kansas Board of Health and two Oklahoma oil companies, is expected to provide an untapped source in the Mid-Continent area for high-melting point paraffin. At present a large quantity of the oil field emulsion which does not respond to conventional demulsifying treatment is being wasted.

The process for salvaging the paraffin from tank bottom emulsions depends upon proper destabilization, very intimate mixing of the emulsion and the demulsifying chemical, heating to a higher temperature than usually employed, and rapid settling of the salt water and foreign matter.

Two methods for separating the clean oil are being tested; one by recovering the wax-bearing oil in a hot tank by gravitational separation and the other by mechanical filtration. Results of the first test show that more than 90 percent of the wax-bearing oil in the waste emulsion is recoverable, but additional research is needed to determine the economics of the mechanical filtration method to eliminate dirt and water.

Copy of the publication entitled: "Report of Investigations 3869, Recovery and Utilization of Oil from Oil-Field Waste Emulsion," may be obtained by writing the Bureau of Mines, Department of the Interior, Washington 25, D. C.

Geology Review

The "Review of Petroleum Geology in 1945" is now available for distribution as Volume 41, No. 3, of the *Quarterly* of the Colorado School of Mines, H. M. Crain, director of publications at the school, has announced. This is the fourth such review published annually in the *Quarterly* in cooperation with the American Association of Petroleum Geologists.

The authors are Dr. F. M. Van Tuyl and Prof. W. S. Levings of the department of geology with members of the faculty of the departments of geology, geophysics, and petroleum engineering.

The publication comprises 203 pages and includes a bibliography of about 1500 listings. The review may be obtained from the department of publications, Colorado School of Mines, Golden, at $2 a copy postpaid.

New Machines Installed at "American"

Installation of new gun-boring machines, for boring of drill collars and kellys, has been completed at American Iron & Machine Works Company, Oklahoma City. This new equipment insures a straight, accurate bore hole. Also installed by "American" is a new thread miller for milling threads on drill collars and kellys.

Rockwell Manufacturing Company Establishes Hydraulics Division

A new hydraulics division, to specialize in the development of hydraulic equipment, has been established by the Rockwell Manufacturing Company, Pittsburgh. W. H. Marsh will be general manager of the division.

W. H. Marsh

Marsh attended Cornell University, where he studied mechanical engineering. He joined the Pittsburgh Equitable Meter Division of Rockwell Manufacturing Company in 1934 after previous experience with Pittsburgh Coal Company, Gulf Refining Company, John F. Casey and the Pennsylvania Pump Company.

The hydraulics division is an outgrowth of the gun pointing program Marsh directed during the last World War, and which was closely aligned with a standard product of the Rockwell Manufacturing Company.

Spang-Chalfant Division Makes Sales Department Promotions

Spang-Chalfant Division of The National Supply Company has made four promotions in an expansion of its sales department. Charles J. Ramsburg, Jr., and Eugene F. Conroy are now assistant district managers of the New York office; Edwin A. Booth is Pittsburgh district manager, and Frank W. Morris is manager of the Tulsa district.

Ramsburg has been manager of the Pittsburgh district since joining the company in 1939 and during the war was also manager of Ordnance Department sales. Conroy was with Central Tube Company from 1913 to 1940, at which time it merged with Spang-Chalfant, and has been a member of the New York sales staff for six years. Booth has been manager of the Tulsa district since 1942. He was first connected with the metallurgical and research departments of the company when employed in 1929. Morris has been with the sales department since graduation in 1923 from the University of Wisconsin, except for two years with American Car and Foundry Company and General Petroleum Corporation of California.

Oil Well Supply Company Opens New Office in Wichita Falls

Oil Well Supply Company, U. S. Steel Corporation subsidiary, has opened an uptown district office in Wichita Falls, Texas, at 702 Staley Building. William Miskimins is North Texas and Panhandle district manager, and Harris W. Quaite, district inventory control supervisor. Previously, the district office was at the Wichita Falls supply store.

Wickwire Spencer Steel Moves General Sales Manager's Office

Wickwire Spencer Steel, division of Colorado Fuel and Iron Corporation, has moved the general sales manager's office from 500 Fifth Avenue, New York 18, to 361 Delaware Avenue, Buffalo 2. This coordinates the offices of A. G. Bussman, vice president in charge of sales, and H. C. Allington, assistant general sales manager; the wire department general office of C. G. Matthews, which also moved to Buffalo with the market research department under Hanry Davis, and the advertising department under S. E. McCrum. The wire rope department under A. S. Rairden has been moved to the plant at Palmer, Mass.

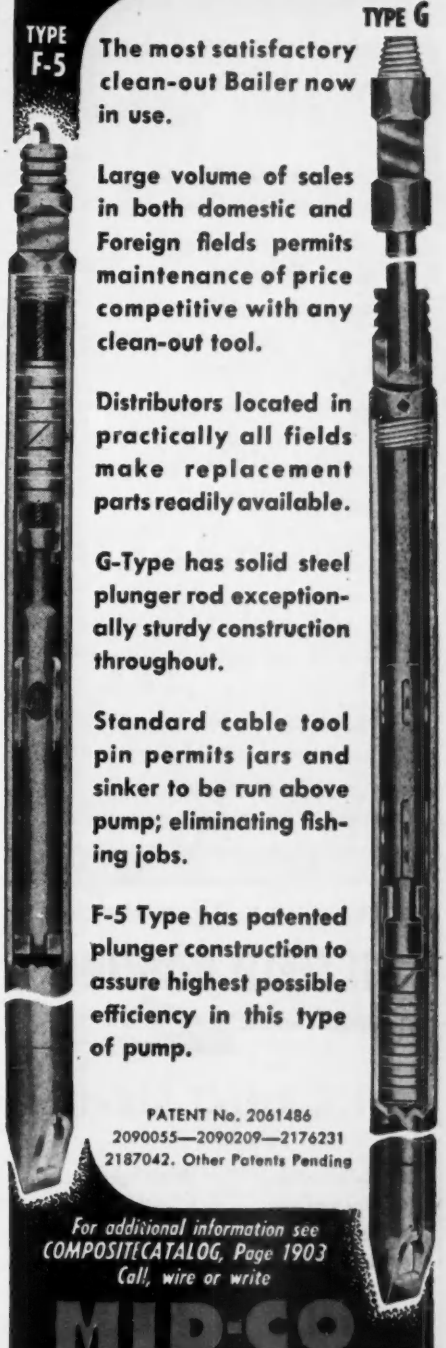
INCREASE PRODUCTION with

MID-CO

CLEAN-OUT BAILER

TYPE F-5

TYPE G



The most satisfactory clean-out Bailer now in use.

Large volume of sales in both domestic and Foreign fields permits maintenance of price competitive with any clean-out tool.

Distributors located in practically all fields make replacement parts readily available.

G-Type has solid steel plunger rod exceptionally sturdy construction throughout.

Standard cable tool pin permits jars and sinker to be run above pump; eliminating fishing jobs.

F-5 Type has patented plunger construction to assure highest possible efficiency in this type of pump.

PATENT No. 2061486
2090055—2090209—2176231
2187042. Other Patents Pending

For additional information see COMPOSITECATALOG, Page 1903
Call, wire or write

MID-CO TOOL and SUPPLY CO.
SUBSIDIARY OF AIMEON MANUFACTURING CORPORATION
1006 - 1012 S. E. 29th STREET
TELEPHONE 7-8586 BOX 1542
OKLAHOMA CITY · OKLAHOMA

DIESEL
JACKET WATER STABILIZATION

Maintain effective cooling . . . eliminate scale formation . . . prevent pitting and corrosion by stabilizing your Diesel Jacket Water. We offer reliable stabilization by intelligent application of standard methods. Phone, write, wire for further information.

25 Years Successful Experience

GULF ENGINEERING CO., INC.
"Service, Not Promises"
307 M. & M. BUILDING, HOUSTON, TEXAS
916 S. PETERS STREET, NEW ORLEANS, LA.

BETTER
Steel Forgings for
CHRISTMAS TREE FITTINGS
BEAUMONT WELL WORKS COMPANY
BEAUMONT, TEXAS

OIL FIELD HAULING

QUICK DIRECT SERVICE to

- Colorado
- Wyoming
- Texas
- Louisiana
- Montana
- Oklahoma
- Kansas
- New Mexico

HILL & HILL TRUCK LINE
P. O. BOX 2565
HOUSTON, TEXAS
Phone: Charter 4-5371

Manufacturers Move Office

The southwest regional office of The National Association of Manufacturers has been moved from the Rio Grande Building to 1101 Commerce Street, Chamber of Commerce Building, Dallas 2. Noah Dietrich is regional vice president and Bob Bourdene, regional manager.

Advertisers' Index

EDITORIAL INDEX, PAGE 21

* Indicates detailed information on products and services included in 1943-44 edition of Composite Catalog of Oil Field and Pipe-Line Equipment.

*American Cable Division, American Chain & Cable Co.	II Cover
Aireon Manufacturing Corp.	95
American Cyanamid Co.	14
*American Iron & Machine Works Co.	78
*Baker Oil Tools, Inc.	24 and 61
Wm. M. Barret, Inc.	96
Beaumont Well Works Co.	96
*Bethlehem Steel Co.	77
*Black, Sivalls & Bryson, Inc.	13
The Bovaird Supply Co.	11
Bowser, Inc.	84
*Cameron Iron Works, Inc.	43
*Chicago Bridge & Iron Co.	III Cover
Circle "D" Ranch	76
Dan L. Clark Drilling Co.	94
W. L. Clay	79
The Colorado Fuel & Iron Corp.	81
*Cummins Engine Co.	7
*Dresser Industries, Inc.	20
*Durbin-Durco	61
The Eagle-Picher Co.	80
*Fairbanks, Morse & Co.	15
Ford Motor Co.	73
Ft. Worth Laboratories	96
The Four Wheel Drive Auto Co.	9
Gemco Oil Tools, Inc.	62
General Motors Corp.	12
Fred I. Getty	74
*Gray Tool Co.	56
Gulf Engineering Co.	96
Hill & Hill Truck Line	96
Houston Laboratories	96
Houston Radio Supply Co.	93
*Hughes Tool Co.	I Cover
Hyatt Bearings Division, General Motors Corp.	12
Industrial and Marine Division, Ford Motor Co.	73
Industrial Chemical Division, American Cyanamid Co.	14
*International Harvester Co.	3
The International Nickel Co.	10
*Jensen Brothers Manufacturing Co.	90
*Jones & Laughlin Steel Corp.	22
*Justrite Manufacturing Co.	92
*Kobe, Inc.	20
Krausse Manufacturing Co.	1
The R. K. LeBlond Machine Tool Co.	76
*LeRoi Co.	83
*Link-Belt Co.	69
The Lufkin Rule Co.	18
M & H Valve & Fittings Co.	89
Marmon-Herrington Co.	17
*Mid-Co Tool & Supply Co.	95
*Mission Manufacturing Co.	IV Cover
Mudrite Chemicals	93
New Bedford Cordage Co.	79
*Nordstrom Valve Division, Rockwell Manufacturing Co.	Insert 48-49
Norton Equipment Co.	93
*The Oil Weekly	85
*Oil Well Supply Co.	63
*Otis Pressure Control, Inc.	8
Owen Tool Co.	91
*The Parkersburg Rig & Reel Co.	19
*Patterson-Ballagh Corp.	55 and 91
*Pelican Well Tool & Supply Co.	82
*Penberthy Injector Co.	60
*Rector Well Equipment Co.	18
Republic Steel Corp.	75
*The Ridge Tool Co.	16
*Rockwell Manufacturing Co.	Insert 48-49
Sandlin Bros.	86
Shell Development Co.	6
Southwestern Life Insurance Co.	4
*Spang-Chalfant Division, The National Supply Co.	52-53
*Standco Brake Lining Co.	96
*Templeton, Kenly & Co.	64
Thomas Motor Freight	80
Thompson-Hayward Chemical Co.	79
*Thornhill-Craver Co.	70
Trading Post Section	88
United States Steel Corp.	63
The Weld Inspection Laboratory	96
*Wheeling Machine Products Co.	93
*The Wheland Co.	2
*Wickwire Spencer Steel Division, The Colorado Fuel & Iron Corp.	81
*Wilson Manufacturing Co.	5
*Wisconsin Motor Corp.	87
York Supply Co.	94
The Youngstown Sheet & Tube Co.	26

William M. Barret, Inc.
Consulting Geophysicists
Specializing in Magnetic Surveys
Contracts accepted for domestic and foreign projects, using the most improved instrumental and interpretative technique.
GIDDENS-LANE BUILDING
SHREVEPORT, LOUISIANA

Standco NO-SMOKE
STANDCO BRAKE LINING
for the easiest brake known. It "feeds off" evenly. Standco never scores brake rims. See page 2808 Composite Catalog.
Standco Brake Lining Co.
HOUSTON

THE FORT WORTH LABORATORIES
Analysis of oil field brines, cores, gas, oil and minerals. Field gas testing. R. H. Fash, Vice President; Long Distance 138. 823½ Monroe Street, Fort Worth, Texas

ASME API ASTM AWS AISC
"Sound Welds Through Tests and Inspection"
THE WELD INSPECTION LABORATORY
Telephone Hadley 3589
3607 Fannin Street, Houston 4, Texas

HOUSTON LABORATORIES
Analytical and Consulting Chemist
Podbielniak Gas Analysis
Oil Field Brines, Waters and Cores
Complete Evaluation of Crude Oils
Long Distance 267 Box 132, Houston, Tex.

BE SURE TO CHECK THE

TRADING POST SECTION

ON PAGE 88 OF THIS ISSUE